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A compilation of the summary portions of the Research and Technology Objectives and Plans *(RTOPS)* used for management and control of research currently in progress throughout NASA has been published under the title *Research and Technology Objectives and Plans Summary, Fiscal Year 1982.* It is announced as accession number N82-24128, NASA-TM-84415, on page 2028 of this issue of *STAR*.

RTOP SUMMARY, FY1982 also should help expedite the NASA program of technology transfer to the private sector.

RTOP SUMMARY, FY1982 may be purchased from the National Technical Information Service, Springfield, Virginia, 22161, for $16.50 in paper copy or $4.00 in microfiche. (The cost for customers outside the United States is $33.00). The accession number N82-24128 (NASA-TM-84415) should be specified when ordering this publication.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

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02 AERODYNAMICS

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 1889

02 AERODYNAMICS 1895

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*

03 AIR TRANSPORTATION AND SAFETY 1898

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1901

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications.*

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1902

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

06 AIRCRAFT INSTRUMENTATION 1903

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

07 AIRCRAFT PROPULSION AND POWER 1904

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

08 AIRCRAFT STABILITY AND CONTROL 1905

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1905

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*

12 ASTRONAUTICS (GENERAL) N.A.

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

13 ASTRODYNAMICS N.A.

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

15 LAUNCH VEHICLES AND SPACE VEHICLES 1906

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1906

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

17 SPACECRAFT COMMUNICATION, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1907

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

19 SPACECRAFT INSTRUMENTATION N.A.

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 SPACECRAFT PROPULSION AND POWER 1908

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

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Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) **N.A.**
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24 COMPOSITE MATERIALS **1908**
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY **1909**
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics.*

26 METALLIC MATERIALS **1913**
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS **1916**
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS **1917**
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics.*

31 ENGINEERING (GENERAL) **1920**
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS **1924**
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

33 ELECTRONICS AND ELECTRICAL ENGINEERING **1926**
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

34 FLUID MECHANICS AND HEAT TRANSFER **1929**
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 INSTRUMENTATION AND PHOTOGRAPHY **1944**
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation.*

36 LASERS AND MASERS **1946**
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING **1947**
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY **1949**
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS **1949**
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences.*

42 GEOSCIENCES (GENERAL) **N.A.**

43 EARTH RESOURCES **1952**
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION **1964**
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION **1982**
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS **1987**
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

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48 OCEANOGRAPHY **2006**
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51 LIFE SCIENCES (GENERAL) **2007**
Includes genetics.

52 AEROSPACE MEDICINE **2008**
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53 BEHAVIORAL SCIENCES **2009**
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT **2009**
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55 PLANETARY BIOLOGY **2010**
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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) **2010**

60 COMPUTER OPERATIONS AND HARDWARE **2010**
Includes computer graphics and data processing.
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61 COMPUTER PROGRAMMING AND SOFTWARE **2011**
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62 COMPUTER SYSTEMS **2015**
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63 CYBERNETICS **2015**
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For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS **2015**
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65 STATISTICS AND PROBABILITY **2016**
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67 THEORETICAL MATHEMATICS **2017**
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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
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70 PHYSICS (GENERAL) **2017**
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Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS **N.A.**
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE **2030**
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION **2030**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) **2030**

89 ASTRONOMY **2031**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS **2031**
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION **2032**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS **2032**
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION **2033**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL **2033**

Note: N.A. means that no abstracts were assigned to this category for this issue.

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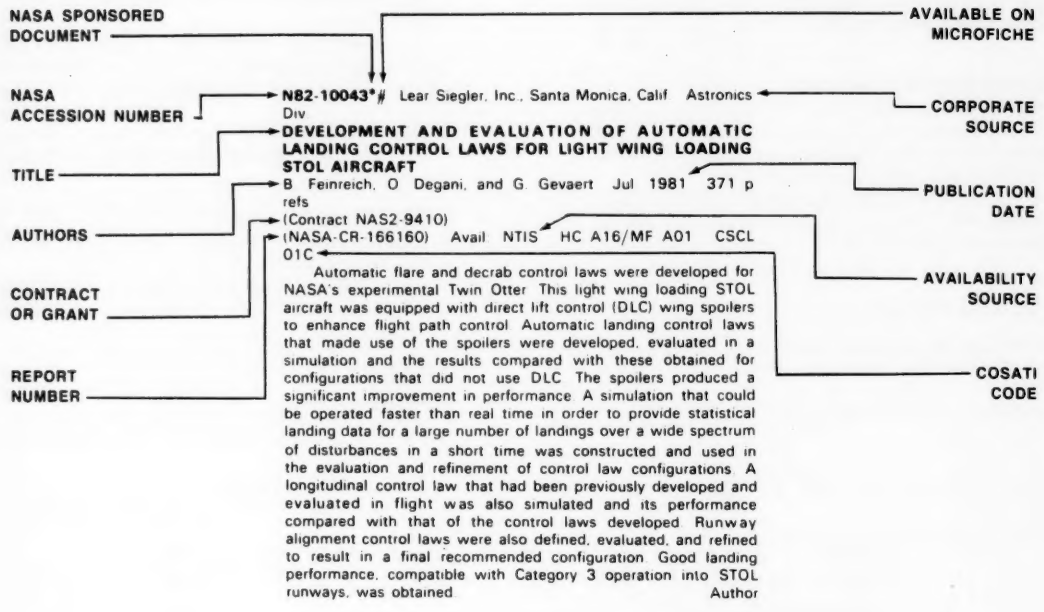
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N82-10043*# Lear Siegler, Inc., Santa Monica, Calif. Astronics Div.
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TITLE
DEVELOPMENT AND EVALUATION OF AUTOMATIC LANDING CONTROL LAWS FOR LIGHT WING LOADING STOL AIRCRAFT
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B. Feinreich, O. Degani, and G. Gevaert Jul. 1981 371 p refs
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Automatic flare and decrab control laws were developed for NASA's experimental Twin Otter. This light wing loading STOL aircraft was equipped with direct lift control (DLC) wing spoilers to enhance flight path control. Automatic landing control laws that made use of the spoilers were developed, evaluated in a simulation and the results compared with these obtained for configurations that did not use DLC. The spoilers produced a significant improvement in performance. A simulation that could be operated faster than real time in order to provide statistical landing data for a large number of landings over a wide spectrum of disturbances in a short time was constructed and used in the evaluation and refinement of control law configurations. A longitudinal control law that had been previously developed and evaluated in flight was also simulated and its performance compared with that of the control laws developed. Runway alignment control laws were also defined, evaluated, and refined to result in a final recommended configuration. Good landing performance, compatible with Category 3 operation into STOL runways, was obtained. Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N82-23150# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
FLUID DYNAMICS OF JETS WITH APPLICATIONS TO V/STOL
Jan. 1982 433 p refs Proceedings of Symp. held at Lisbon, 2-5 Nov. 1981
(AGARD-CP-308; ISBN-92-835-0308-2) Avail: NTIS HC A19/MF A01

The fluid dynamics of vertical and short take-off and landing aircraft which employ thrust vectoring or lift augmentation were discussed. Jet interactions with neighboring surfaces, jet structure and development, wind tunnel simulation, injection and thrust augmentation, and theoretical models were considered. For individual titles, see N82-23151 through N82-23181.

N82-23151# Surrey Univ., Guildford (England). Dept. of Mechanical Engineering.
SOME ASPECTS OF JET DYNAMICS AND THEIR IMPLICATIONS FOR VTOL RESEARCH **c05**
L. J. S. Bradbury *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 26 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Some of the problems associated with jet interference on VTOL aircraft are discussed. The jet interference that arises in hovering both in and out of ground effect is considered first and the factors that influence the entrainment that is responsible for the interference are discussed. In particular, it is shown that the flow in the initial region of a jet is strongly affected by circumferential variations in the jet nozzle flow angle and that this might account for some of the anomolous results for the decay of jets issuing from VTOL models. The possible use of Reichardt's method for studying the behavior of nonuniform jets is also discussed. The problem of jet interference in transition is next examined and the basis on which model tests are currently carried out is briefly reviewed. The dynamics of jet interference in transition are then considered in more detail and it is suggested that unlike interference in hovering, transition interference might well be accounted for on the basis of a potential flow model of the jet in a cross flow. Some experimental evidence in support of this notion is examined and a few examples of comparisons between predicted and experimental pressure distributions around a single jet issuing from a flat plate are given. Author

N82-23152# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
JET INTERACTIONS WITH NEIGHBORING SURFACES **c02**
J. Barche *In* AGARD Fluid Dyn. of Jets with Appl. of V/STOL Jan. 1982 18 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Current knowledge and prediction methods for jet interactions with neighboring surfaces are briefly reviewed with special attention to transport and V/STOL aircraft. Examples of primary and secondary interference phenomena are reviewed. Subsonic and sonic jets from zero forward speed up to the transonic flight regime were considered. Problems of transport aircraft design and military jet V/STOL aircraft are discussed. The interaction problems discussed indicate that the phenomena are well understood. Prediction capabilities are still limited, due to difficulties in the theoretical modeling of three dimensional turbulent flows. Some specific problems can be handled on the basis of potential/theoretical flow, provided that the boundary conditions are properly given. J.D.

N82-23153# Coimbra Univ. (Portugal). Dept. of Science and Technology.
INTERACTION OF SIMPLE AND MULTIPLE JETS WITH A PLANE SURFACE **c02**
A. R. Janeiro Borges (Univ. Nova de Lisboa) and D. X. Viegas *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The shear stress field produced by simple and multiple circular jets impinging on a plane surface with either normal, oblique, or parallel incidence was studied. The mean shear stress distribution produced by a single normal jet was measured with a Preston tube. A law for the radial variation of tau sub w is proposed for the wall jet region. Measurements of the shear stress fluctuations with a hot film sensor showed that the intensity of the fluctuations is small compared with the shear stress mean value. An erosion technique was employed to evaluate the shear stress field. The calibration of the technique for sand particles was done in the flow produced by a normal jet. The variation of tau sub w and lines of constant shear stress were obtained for oblique and parallel impingement. In the latter case a dual jet arrangement was also considered. An analytical model, based on Reichardt inductive theory of free turbulence, is developed for the description of the mean properties of the flow produced by single and dual jets parallel to the plane. Author

N82-23154# Laval Univ. (Quebec). Dept. de Genie Mechanique.
THE REATTACHMENT OF TWO JETS ON THEMSELVES [RECOLLEMENT DE DEUX JETS SUR EUX-MEMES] **c02**
Claude Bourque *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs In FRENCH (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The reattachment of two incompressible turbulent jets on themselves was studied experimentally and theoretically. These jets with different amounts of movement issue from nozzles with initial directions somewhat separated by a solid wall. They then encircle before meeting a dead zone with depression or with pressure, according to the relative initial direction of the jet. Experimentally, the position of the dead point corresponding to reattachment was determined by different values of the geometric parameter. The velocity profile in the resulting jet was measured and the direction as well as the position of this jet was determined.

Theory gives the position of the point of reattachment in dead water, between the initial jets and the development of the resulting jet. Transl. by A.R.H.

N82-23155# Instituto Superior Tecnico, Lisbon (Portugal). Dept. of Mechanical Engineering.

JETS IMPINGING NORMALLY AND OBLIQUELY TO A WALL **c02**

S. R. B. Araujo, D. F. G. Durao, and F. J. C. Firmino *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 10 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

An experimental study of a developing jet impinging normally and obliquely on a smooth wall is presented. A laser Doppler anemometer incorporating a frequency shift device was used to measure the mean and fluctuating velocity components in the free jet and wall jet regions. Twelve nozzle diameters downstream of a 14.0 mm diameter nozzle, the jet had mean velocity profiles which were found to have reached similarity with a center line turbulence intensity of around 20%. A circular plate was placed at this location and the radial and circumferential development of the wall jet was analysed for impinging angles from 0 to 20 degrees. The values of the maximum velocity and of the distance from the wall to the location where the velocity is half the maximum velocity depend on radial distance and impinging and circumferential angles. The opposite is true for the nondimensionalized mean velocity profiles which are independent from those parameters. In the fully developed wall jet, the turbulence intensity was always in excess of 30%, and the location of minimum normal stress coincide ł with that of maximum mean velocity. The velocity probability distributions show the large influence that the outer layer of free turbulent mixing has on the boundary layer region adjacent to the plate. The rate of growth of radial wall jets is smaller than that of radial free jets. Author

N82-23156# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

AN INVESTIGATION OF INCLINED JETS IN A CROSSWIND **c02**

P. Taylor and D. J. Watkins *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs Sponsored in part by SERC (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

The interference characteristics of a turbulent inclined jet exhausting into a turbulent subsonic crosswind were investigated. Results are presented of the variation in jet paths (based on the maximum total pressure), the lift loss, and the pressure distribution on a flat plate through which the jet exhausts. The angle of inclination of the jet to the crosswind direction has varied from 90 to 15 deg. It was found that the lift loss, the jet deflection, the jet penetration, and the rate of total pressure decay along the jet path decreased as the jet inclination was reduced from the position normal to the crosswind. The center of pressure moved downstream. A jet exhausting at an angle of 15 deg to the crosswind has received considerable attention recently and results are presented of the variation with increasing momentum ratio of the pressure distribution on the flat plate through which the jet exhausts, the lift loss, the jet paths, and surface oil flow. Similarity laws are applied to the lift loss, jet path, and center of pressure as a function of momentum ratio, geometry, and angle of inclination. J.D.

N82-23157# Louisiana State Univ., Baton Rouge. Dept. of Mechanical Engineering.

AN EXPERIMENTAL INVESTIGATION OF AN UPPER SURFACE BLOWING CONFIGURATION **c02**

G. D. Catalano, J. B. Morton, and R. R. Humphris *In* AGARD Fluid Dyn. of Jets with Appl. of V/STOL Jan. 1982 14 p refs Prepared in cooperation with Virginia Univ. (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

The effects of both a flat and a curved wall on the one, two, and three point statistical properties of a coflowing turbulent jet are documented. Mean velocities, turbulent intensities, auto- and cross-velocity correlating functions, auto- and cross-velocity spectra, and isocorrelation contours are determined by use of a laser Doppler velocimeter with phase locked loop processor. Pressure field coherence and phase angle function as well as pressure velocity correlations are made using a condensor type microphone/recorder. The effects of varying ratios of the nozzle exit plane mean velocity to the outer tunnel flow speed is noted. The confining surfaces serve to radically change the flow pattern of the expanding turbulent jet. The curved wall has the effect of rapidly increasing the turbulence in the potential core region and disrupting the large scale turbulent structure of the jet. The pressure velocity correlation functions indicate a strong coupling among the turbulent velocity, species concentration fluctuations, and pressure fluctuations in the jet near field. Author

N82-23158# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE INTERACTION BETWEEN THE ENGINE JET AND THE SURROUNDING FLOW FIELD WITH REGARD TO THE PRESSURE DRAG ON AFTERBODIES **c02**

A. Zacharias *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 22 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

In order to clarify the interaction between rotationally symmetric engine jets and afterbody configurations, the dependence of the jet characteristics (i.e., the plume effect and the entrainment) and the afterbody pressure drag on the jet parameters, the free stream Mach number, and the afterbody geometry was analyzed. Extensive tests were carried out in the high subsonic Mach number range on three different afterbodies at Reynolds numbers from 500,000 to 1,300,000. The nozzle pressure ratio and the temperature ratio of the model jets were varied in the range (1.0) 1.2 to 2.4 and 1.0 to 2.86 respectively. Measurements were then carried out to determine the static pressure and temperature distribution as well as the boundary layer profiles over the surface of the models. At the same time, the pressure and temperature profiles in the jet were determined in several planes behind the jet exhaust plane. Empirical equations are presented which show the dependence of the plume effect, the entrainment, and the afterbody pressure drag on the jet parameters, the free stream Mach number, and the afterbody geometry. With the aid of a finite element method and theoretical potential flow model for jet simulation, a numerical procedure was developed which allows the pressure drag on rotationally symmetric afterbodies to be calculated with due allowance for the effects of the engine jets. Comparison of the theoretical and experimental results shows satisfactory agreement. J.D.

N82-23159# Ecole Centrale de Lyon (France). Lab. de Mechanique des Fluides.

STRUCTURE AND DEVELOPMENT OF TURBULENT JETS **c02**

J. Mathieu and G. Charnay *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 23 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

The behavior and the modeling of turbulent jet flow are surveyed. The essential ideas are discussed in connection with industrial and aeronautical applications. After an introduction of the quasi-equilibrium state related to the length and time scales, the coherent structures and spreading processes are analyzed. Specific topics considered are the intermittency in the axial region, the characteristics of the production centers of the turbulent kinetic energy, the round and plane jet, the acoustic properties with their interactions with the turbulent structure, the initial conditions, and the phenomena in the stagnation region of an impinging jet. A general review of modeling methods precedes examination of computations carried out in physical space and of the large eddy simulation approach. J.D.

N82-23160# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.

A ROW OF JETS IN A CROSSFLOW **c02**

Z. A. Khan, J. J. McGuirk, and J. H. Whitelaw *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 11 p refs Sponsored in part by Science Research Council and Rolls-Royce Ltd. (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

Measurements and calculations for the flow downstream of a row of round jets discharging vertically into a confined horizontal cross stream are reported. No impingement of the jets occurs on the upper wall even for larger pitch to diameter ratios (S/D) and smaller tunnel height to diameter (H/D) values. Although jet spreading rates are similar for both S/D ratios studied, the rapid loss of individual jet identity for the smaller value is illustrated by differences in the measured velocity contour shapes on the farthest downstream cross plane. The calculated results were obtained by solving the steady three dimensional elliptic form of the Reynolds equations with a two equation model of turbulence. The effect of grid refinement is examined. Results for lower S/D ratios are shown to be sensitive to changes in boundary conditions. Comparison with the measured data shows good agreement for the larger S/D, but only certain features are well predicted for the lower value. The influence of the blockage parameter on flow development is quantified. J.D.

N82-23161# Queen Mary Coll., London (England).
EXPERIMENTAL INVESTIGATION OF INITIALLY PLANAR JETS INCLINED TO AN EXTERNAL FLOW **c02**
Y. Pontikis, R. A. Feik, and A. D. Young *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The development of a jet emerging from a full span narrow slit at the trailing edge of a thin aerofoil in a wind tunnel was examined. The jet could therefore be regarded as two dimensional. Three angles of jet inclination to the main flow were tested (10, 20 and 30 deg) and two values of the ratio of the undisturbed stream velocity to the jet exit velocity (0.21 and 0.33). Half the slit was then blocked resulting in a finite span jet with a streamwise edge, and the development and rolling up of the edge region was studied for a jet inclination angle of 30 deg. The measurement covered mean flow and turbulence characteristics. The mean velocity distributions in the two dimensional jets showed a ready tendency to similarity with distance downstream from the jet exit, but the turbulence characteristics in the upper and lower halves showed significant differences consistent with the known effects of streamline curvature. The finite jet assumed a dumbbell shape in section, the edge region growing inwards with distance downstream. There were significant differences between the mean velocity and streamwise vorticity distributions and their peaks followed markedly different loci. Author

N82-23162# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RESONANT ENTRAINMENT OF A CONFINED PULSED JET **c02**
Pradip G. Parikh *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 10 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The discovery of a resonant entrainment phenomenon associated with a confined, pulsed jet flow is reported. It was found that a confined jet, when pulsed at an organ pipe resonant frequency of the confinement tube, experiences greatly enhanced entrainment and mixing near the exit end of the confinement tube. Both visual and quantitative evidence of this phenomenon is presented. The effect should be of considerable interest in ejector and combustor design, both of which benefit from any enhancement in mixing between a primary and a secondary flow. Author

N82-23163# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft- und Raumfahrt.
FLOWFIELD AND NOISE SOURCES OF JET IMPINGEMENT OF FLAPS AND GROUND SURFACE **c02**
Guenther Neuwerth *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 7 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

On the basis of experimental results it is shown that, in an undisturbed free jet of high subsonic speed as well as in a jet deflected by externally blown flaps (EBF), there are ordered turbulence structures. First, a feedback mechanism which develops at small distances between nozzle and stagnation point on the flaps and which amplifies the turbulence structures is explained. It is subsequently shown that the interaction of the jets and EBF generates a strong noise. Even without feedback both the undisturbed free jet and the jet deflected by EBF have the maximum levels in the noise spectrum at the Strouhal numbers of the natural ordered turbulence structures. Author

N82-23164# Trondheim Univ. (Norway). Inst. for Mekanikk.
THE NEAR FIELD OF A PLANE TURBULENT JET **c02**
Leif N. Persen *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 18 p refs Sponsored in part by Royal Norwegian Council for Scientific and Industrial Research (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

A series of experiments performed in the near field of the nozzle producing a plane turbulent jet is described. The jet opening is varied in size and geometry, the exit velocity is varied, and the measuring device is varied from an ordinary pitot tube to the double hot-wire anemometer whereby also the Reynolds stresses could be measured. The experimental data are considered in the light of theoretical considerations which start out with an examination of the classical boundary layer approach. The conclusion is drawn that information must be extracted from the complete set of equations governing the problem. For this purpose the Neuber three function approach is applied to gain insight into the relations governing the Reynolds stresses. The concept of self-similarity is discussed and it is shown why the concept used by Townsend applies only in the far field of the jet. The concept introduced by Bradbury and Riley of two different regions of similarity is not supported by the present approach. It is shown that the data in the near field suggest a correlation which has the linear spreading of the jet as an asymptotic behavior. A new concept of propagation of disturbances is applied to the distribution of the Reynolds stresses. J.D.

N82-23165*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
JET V/STOL WIND-TUNNEL SIMULATION AND GROUND-PLANE EFFECTS **c02**
Richard J. Margason *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 21 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

The pretest preparation necessary to define the objectives of an appropriate investigation into the jet V/STOL wind tunnel simulation and ground plane effects were examined. Low speed wind tunnel testing of V/STOL aircraft concepts to determine the aerodynamic propulsion interaction effects during the transition between hover and wingborne flight is a necessary step in the development cycle of this type of aircraft. Powered models are normally used to determine the aerodynamic performance characteristics. Several factors which influence the selection of the model concept and the engine simulator are discussed. Some of the test techniques important for this class of aircraft model are examined. Wind tunnel wall effects important to this aircraft testing with special emphasis on groundplane effects are reviewed. E.A.K.

N82-23166*# McDonnell-Douglas Corp., St. Louis, Mo. Aerodynamics Dept.
THE MODELING AND PREDICTION OF MULTIPLE JET VTOL AIRCRAFT FLOW FIELDS IN GROUND EFFECT **c02**
Donald R. Kotansky *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 20 p refs (For primary document see N82-23150 14-01)
(Contracts NAS2-9646; NAS2-10184; N62269-76-C-0086; N00014-79-C-0130)
Avail: NTIS HC A19/MF A01 CSCL 01A

An engineering methodology based on an empirical data base and analytical fluid dynamic models was developed for the prediction of propulsive lift system induced aerodynamic effects for multiple lift jet VTOL aircraft operating in the hover mode in and out of ground effect. The effects of aircraft geometry, aircraft orientation (pitch, roll) as well as height above ground are considered. Lift jet vector and splay directions fit the airframe, lift jet exit flow conditions, and both axisymmetric and rectangular nozzle exit geometry are also accommodated. The induced suckdown flows are computed from the potential flowfield induced by the turbulent entrainment of both the free jets and wall jets

in ground effect and from the free jets alone out of ground effect. The methodology emphasized geometric considerations, computation of stagnation lines and fountain upwash inclination, fountain upwash formation and development, and fountain impingement on the airframe. E.A.K.

N82-23167# Grumman Aerospace Corp., Bethpage, N.Y.
EVALUATION OF THE EFFECTS OF MODEL SCALE AND TEST TECHNIQUE ON JET-INDUCED EFFECTS **c05**
Stanley G. Kalemaris *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 11 p (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The effects of model scale and test technique on the jet induced of a twin turbofan V/STOL aircraft were evaluated. The smallest mode was 2.1% as large as the full scale model. It is found that the two most important items to be modeled are fuselage shape and the coannular nature of a typical turbofan exhaust. Lift enhancing strakes are effective in enhancing the ground cushion and eliminating a possible source of scale effect. E.A.K.

N82-23168# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
JET EFFECTS ON FORCES AND MOMENTS OF A VSTOL FIGHTER TYPE AIRCRAFT **c05**
B. Haftmann *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Results of jet effects on forces and moments of the VAK-191 B were compiled. The jet induced effects were investigated during the Vertical/Short Take-Off and Landing (VSTOL) mode in and out of ground effect, in yawed flight, during hover and transition right up to aerodynamic flight. The flight test results were compared with wind tunnel measurements performed during the VAK-191 B development phase and used for preparation of simulation and automatic flight control system development. Trends and deviations between aircraft and model test results are verified. The adequacy of wind tunnel data preparation are questioned. The practicability of wind tunnel data for the assessment of VSTOL aircraft design and determination of flight characteristics and performances are discussed. Recommendations for the measurements of jet induced forces and moments on VSTOL aircraft are outlined. E.A.K.

N82-23169# Aeronautical Research Associates of Princeton, Inc., N. J.
THRUST AUGMENTING EJECTORS: A REVIEW OF THE APPLICATION OF JET MECHANICS TO V/STOL AIRCRAFT PROPULSION **c07**
Brian Quinn *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The fundamental role played by the fluid dynamics of jets within thrust augmenting ejectors that are designed as propulsive units for V/STOL aircraft were reviewed. Energy transfer efficiency and its impact on the production of thrust is discussed. It is explained why propellor like devices more effectively convert available energy to thrust and that overall ejector performance is very sensitive to losses sustained by individual components. The most important loss mechanism is incomplete mixing between the ejector's primary and entrained streams. An experimental data base that provides insight into interactions between turbulent mixing and other factors and improving mixing and ejector performance are reviewed. Free mixing and mixing in a confined environment are contrasted and it is concluded that the development of theoretical methods that successfully predict the performance of V/STOL ejectors must await the results of new experiments that measure turbulence intensities and Reynolds stresses in confined regions. E.A.K.

N82-23170# Centre d'Etudes et de Recherches, Toulouse (France). Dept. of Aerothermodynamique.
THEORETICAL OPTIMISATION AND EXPERIMENTAL VERIFICATION OF AN INJECTOR **c07**
A. Mignosi *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs In FRENCH; ENGLISH summary (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

A modelization of induction systems, which could be used for thrust augmentation or more generally constitute a fluid drive system, is proposed for the steady regime case. A simple scheme in which a rapid mixing of the flows is assumed, allows to solve the basic equations and express the main parameters influence. Its verification is effected, using a set of experimental data obtained during the study of an induction driven wind-tunnel. Various parameters (are ratio between injected and driven flows, Mach number, pressure and temperature ratios) are studied. The injector configuration also appears to be very important, in particular as to pressure fluctuations produced at injection and the corresponding aerodynamic noise in the wind tunnel. Author

N82-23171# West Virginia Univ., Morgantown. Coll. of Engineering.
UNSTEADY EJECTORS **c34**
Herman Viets *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs (For primary document see N82-23150 14-01)
(Grant AF-AFOSR-0025-81)
Avail: NTIS HC A19/MF A01

Ejectors are examined by introducing a time dependency into the flow to increase the mixing rate and hence improve the performance of very short devices. Past studies of unsteady flows related to ejectors are reviewed and a device is proposed which has the potential to increase the mixing by means of both an unsteady flow and also acoustic interaction between the frequencies generated by the jet and the ejector shroud. Standing acoustic waves are identified in the ejector and, it is found that the short unsteady ejector performance is superior to that of a slot jet geometry. E.A.K.

N82-23172# Universite Scientifique et Medicale de Grenoble (France). Inst. de Mechanique.
IMPROVEMENT OF EJECTOR THRUST AUGMENTATION BY PULSATING OR FLAPPING JETS **c07**
G. Binder and H. Didelle *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 11 p refs Sponsored in part by Minstere de la Defense (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The influence of pulsating or flapping motions forced on the primary jet on the performance of thrust augmenting ejectors was investigated. The effect of the frequency and the amplitude of the forced perturbations was determined for various mixing duct lengths and diffusor geometries. In constant area ejectors the improvement in thrust augmentation ratio over the performance obtained with a steady jet in the same geometry increases with decreasing duct length. Thrust augmentation further improved by the gain in diffusor pressure recovery produced by the unsteady jets. Maximum augmentations of 1.9 and 1.65 were obtained with pulsating and flapping jets respectively as compared to 1.35 and 1.5 in the steady case. These improvements in ejector performance are mainly due to the faster mixing produced by these jets. E.A.K.

N82-23173# Societe Bertin et Cie, Plaisir (France).
EXPERIMENTAL STUDY OF A JET DEFLECTOR [ETUDE EXPERIMENTALE D'UN DEVIATEUR DE JET] **c02**
M. Lepretre and C. Portier *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 20 p refs In FRENCH; ENGLISH summary Sponsored in part by Delegation Generale pour l'Armement (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

A provisional model of an aerodynamic device for orienting the thrust vector of a jet engine was set up by exploiting the reattachment properties of a sonic or slightly supersonic jet on a flat or curved deflector conveniently positioned downwards from the nozzle outlet. A parametric study shows that it would be possible to obtain important reverse rates without a drastic loss of the resultant thrust. Such a device can be of benefit in improving controllability during combat or in designing a STOL. The arrangement defined is characterized by great simplicity, the jet reattachment is spontaneous over all the explored area,

and no extra systems are required for blowing or suction.
Transl. by A.R.H.

N82-23174# Alfa Romeo S.p.A., Naples (Italy).
TURBOPROP AND TURBOJET EJECTOR OPTIMISATION **c07**
V. P. Riviello, A. Murolo, and G. Torella (Italian Air Force Academy) *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The off design performance of turboprop and turbojet engine with ejector exhaust ducts was investigated during the AR 318 turboprop engine development and certification program. The optimization of the matching between angle and exhaust duct system is developed. A theoretical approach is used by a synthesis program the appropriate numerical simulation of the ejector, both in the case of subsonic condition at the engine exhaust station and in a sonic station, with supersonic development of the flow through the ejector. To study the supersonic flow through the ejector a set of available experimental results is examinated to evaluate the reliability of theoretical methods for the secondary flow and for conditions. Hot condition experimental tests were performed and was compared with theoretical calculations. The next step concerns the installation of a suitable ejector system on the AR 180.10 turbojet engine, which is a derived version of the AR 318 turboprop. E.A.K.

N82-23175# Aeronautical Research Associates of Princeton, Inc., N. J.
ON THE INCLUSION OF INFORMATION ON EDDY STRUCTURE IN SECOND-ORDER-CLOSURE MODELS OF TURBULENT FLOWS **c34**
Coleman duP. Donaldson and Guido Sandri *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs (For primary document see N82-23150 14-01)
(Contract F44620-76-C-0048)
Avail: NTIS HC A19/MF A01

The difficulties inherent in second order closure modeling are reviewed. The impropriety of using universal single scale equations in closing the equations is discussed. Defining a simple tensor scale and deriving equations for its component from a moment expansion of the two point correlation tensor equation is outlined. The results are compared with experimental data from nearly homogeneous shearing flows. E.A.K.

N82-23176# Tennessee Univ., Knoxville. Dept. of Engineering and Mechanics.
A THREE-DIMENSIONAL FINITE ELEMENT ALGORITHM FOR PREDICTION OF V/STOL JET-INDUCED FLOW-FIELDS **c34**
A. J. Baker, P. D. Manhardt, J. A. Orzxechowski, and K. T. Yen (Naval Air Development Center, Warmister, Pa.) *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs Prepared in cooperation with Computational Mechanics Consultants, Inc. (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

A three dimensional mathematical model of the basic V/STOL jet, and the flow in the associated near field using a formal order of magnitude analysis was constructed. This produces a parabolized approximation to the steady, time averaged, three dimensional Navier-Stokes equations for a turbulent subsonic flow. A continuity constraint finite element numerical solution algorithm is identified, which independently enforces ordered phenomena for solution of the equation system including transport equations for turbulence kinetic energy and dissipation parameters. The numerical solution of the established equation system yields prediction of core vortex roll up, far field deflection of the cross flow, near field entrainment of the cross flow into the jet, and wake flow reversal with additional entrainment into the jet core. The primary causal mechanism is computationally assessed to be the turbulence interaction on the upstream face of the jet, as verified by results from a range of computational experiments. E.A.K.

N82-23177# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
PREDICTION OF PROPULSION INDUCED EFFECTS IN TRANSITION USING A MODIFIED JET WAKE MODEL **c02**
M. M. Walters and K. T. Yen *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Improvement of the prediction of the induced surface pressures in the wake area without altering the existing accuracy for the area head of the jet was studied. Two short lived, low strength vortices were incorporated into the wake area of the existing Wooler jet model, and the location and strength were determined. The prediction of the induced surface pressure on a flat plate resulting from the modified Wooler model improved the accuracy of the existing model for a range of velocity ratios. The modified model resulted in significant improvement in the prediction of the induced lift on a complete V/STOL configuration. E.A.K.

N82-23178# Bochum Observatory (West Germany).
EFFECTS OF BUOYANCY AND ENTRAINMENT ON HOT FREE JETS AND WALL JETS **c34**
K. Gersten, F. V. Schulz-Hausmann, and S. Schilawa *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 9 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Two dimensional hot free jets and wall jets including buoyancy and entrainment effects were investigated. The flows of hot exhaust gas jets are strongly influenced by buoyancy forces as well as by entrainment effects which in turn depend on the location of the jets with respect to the ground or other geometrical boundaries. When the hot jets impinge the ground, hot wall jets develop along the ground, again under the influence of buoyancy and entrainment effects. E.A.K.

N82-23179*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL AIRCRAFT AND FLUID DYNAMIC **c34**
Leonard Roberts (Stanford Univ.) and Seth B. Anderson *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 5 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

The impact of military applications on rotorcraft and V/STOL aircraft design with respect to fixed wing aircraft is discussed. The influence of the mission needs on the configurational design of V/STOL aircraft, the implications regarding some problems in fluid dynamics relating to propulsive flows, and their interaction with the aircraft and the ground plane, are summarized. E.A.K.

N82-23180# Technische Hochschule, Aachen (West Germany). Inst. Aerodynamisches.
INVESTIGATION OF WALL JETS **c34**
E. Krause, D. Haenel, and N. I. I. Newedy *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 5 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

The interaction between wall jets and the main flow is studied by means of experimental and numerical investigations. The following jet configurations are considered: tangential injection of a jet through a slot in a forward facing step into a boundary layer, which is tripped at the leading edge, and tangential and slightly inclined injection of a jet through a slot in a rearward facing step. S.L.

N82-23181# Kingston Polytechnic, Kingston-Upon-Thames (England). School of Mechanical, Aeronautical and Production Engineering.
THE CALCULATION OF JET INTERFERENCE PRESSURE DISTRIBUTION USING INTEGRAL AND NUMERICAL METHODS BASED ON ACTUAL MEASUREMENTS OF ENTRAINMENT **c34**
Philip E. C. Ransom and John H. Barnes *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

Factors influencing interference effects on aerodynamic surfaces surrounding jets are discussed. A tracer gas method is used for the measurement of jet entrainment. This technique is applied to the study of axisymmetric free jets. A numerical method is developed which employs measured values of entrainment to

compute the interference pressure distribution over a flat surface surrounding the jet. Comparisons are made with theory to show that computational inaccuracies may be reduced to required values. S.L.

N82-23182# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
GUIDANCE AND CONTROL TECHNOLOGY FOR HIGHLY INTEGRATED SYSTEMS
Feb. 1982 179 p refs In ENGLISH and FRENCH The 33rd Symp. held in Athens, 13-16 Oct. 1981
(AGARD-CP-314) Avail: NTIS HC A09/MF A01

The guidance and control implications and realizations for systems functioning within highly integrated environments are addressed. Particular attention is given to the coupling of weapons delivery to flight control systems, terrain following guidance, command and control, and target identification and tracking. For individual titles, see N82-23183 through N82-23189.

N82-23183# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
INTEGRATED NAVIGATION-TF/TA-SYSTEM BASED ON STORED TERRAIN DATA PROCESSING **c04**
Horst-Dieter Lerche *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 13 p (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

A method to improve the reliability and optimization of terrain following flight is discussed. The terrain parameter comparison (TERPAC) system is described in which the main source of information is a terrain data base aboard the aircraft. The comparison is done in the position-fix-mode by matching the measured terrain signatures against terrain reference signatures stored in the mass memory. A hardware and software design of the combined navigation and terrain following/avoidance flight control system was developed and adapted to a modern avionic system architecture. M.G.

N82-23184# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
OPTIMAL INERTIAL NAVIGATION USING TERRAIN CORRELATION: AN ATTRACTIVE SOLUTION TO THE GROUND ATTACK AIRCRAFT NAVIGATION PROBLEM **c04**
L. Camberlein, M. deCremiers, and D. Chermette *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 15 p In FRENCH; ENGLISH summary (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

The use of terrain correlation for all-weather penetration and ground attack aircraft is discussed. Positioning by terrain correlation is briefly reviewed. For the ground attack aircraft application special algorithms allow large heading freedom over the updating area. The parameter sensitivity of the updating accuracy is analysed. This includes the terrain characteristics, the cartography accuracy, and the altitude measurement accuracy. The main operational features for ground attack aircraft are summarized: tri-dimensional updating; high accuracy facilitated by low altitude flight; self-contained, secure, jam-resistant, automated operation; a low level of heading constraint to and over the updating area; savings in weight, volume, electrical power and cost using sensors already needed on the aircraft. The principle of inertial system optimal updating is also briefly discussed. Temporal carryover from position and velocity updates can be crucial for accurate horizontal terrain following and weapon delivery initialization and in-flight alignment of tactical missiles. The possibility of integrating correlation and optimal filtering in the inertial unit is shown. A typical all weather ground attack mission scenario is described. This includes the extensive mission preparation, the nominal flight plan and possible alternatives, update area selection using ground based equipment and map data bases, and the data assembly and cassette loading. A possible operational systems architecture is described with the necessary equipment. M.G.

N82-23185# McDonnell Aircraft Co., St. Louis, Mo.
INTEGRATED FLIGHT AND FIRE CONTROL DEMONSTRATION ON AN F-15B AIRCRAFT: SYSTEM DEVELOPMENT AND GROUND TEST RESULTS **c08**
R. J. Landy, C. A. Scolatti, and J. E. Hunter (AFWAL) *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 17 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

An integrated flight and fire control (IFFC) system is described which utilizes an automatic coupler and modified flight control system to steer out tracking errors calculated by a director fire control system using information from an ATLIS 2 electro-optical tracker. The F-15B aircraft is the test bed aircraft. Simulation and analysis results indicate that the IFFC system has excellent air-to-air gunnery accuracy with decreased pilot workload. These results also indicate that attacker survivability in air-to-ground gunnery and bombing encounters can be increased by using maneuvering approaches without compromising air-to-ground weapon delivery accuracy. Extensive ground testing of IFFC hardware and software is described. Details of the flight test program plan are presented. M.G.

N82-23186# Singer Co., Wayne, N. J.
THE INTEGRATION OF MULTIPLE AVIONIC SENSORS AND TECHNOLOGIES FOR FUTURE MILITARY HELICOPTERS **c06**
Albert J. Shapiro *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 21 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

Multi-sensor navigation systems already available and in use in helicopters are discussed followed by a review of the system trade-offs and considerations leading to new systems that use more advanced digital electronic techniques to achieve the goals of reduced pilot workload, improved performance at minimum size, weight, and cost. The beneficial impact of ongoing technological advances in improving the operating capabilities of future avionics systems is indicated. R.J.F.

N82-23187# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Plans and Management Information Dept.
PRODUCTION VERIFICATION TESTING (PVT) OF GUIDANCE AND CONTROL SYSTEMS FOR HIGH RELIABILITY **c05**
Paul J. Logus *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 11 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

The testing of equipment for highly integrated guidance and control systems is addressed. A departure to the usual acceptance testing is discussed by examining in some detail a technique called production verification testing (PVT). Some of the recent literature and experience is reviewed. Computer simulation are used to examine various facets of PVT. Particular emphasis is directed toward the implementation of 100% testing of all systems prior to delivery through the use of N sequential failure-free cycles. Finally, conclusions drawn from computer simulations are presented. The number of N sequential failure free cycles that may be necessary is suggested, providing insight into interpreting the results. Simulation results suggest a means for determining not only expected operational reliability but also process control problems during manufacturing. R.J.F.

N82-23188# Raytheon Co., Bedford, Mass. Missile Systems Div.
HARDWARE-SOFTWARE TRADE-OFFS FOR DIGITAL FLIGHT CONTROL OF GUIDED MISSILES **c15**
F. William Nesline and Paul Zarchan *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 25 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

Hardware and software requirements are compared for guided missile flight control systems. The utility and application of three main analog flight control systems are discussed - the open loop system, the rate gyro controlled system, and the accelerometer controlled system. For each of these analog systems, digital requirements are derived and comparisons of the requirements and performance of each system are made. The discussions point out hardware and software trade-off issues that occur in the design process. B.W.

N82-23189# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF COMPUTING SYSTEM CONFIGURATIONS FOR HIGHLY INTEGRATED GUIDANCE AND CONTROL SYSTEMS **c08**
J. Edwin Jones, Jay S. Karmarkar, and Randall E. Fleming *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 9 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

The importance of early and sustained validation of architectures for highly integrated systems is discussed. Two early validation tools are presented. A description of the two tools, (1) generalized reliability and maintainability program (GRAMP), and (2) functional emulation, is presented, along with a discussion of their utility in the development of highly integrated guidance and control systems. B.W.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N82-23190 Royal Aircraft Establishment, Farnborough (England).
LINE-VORTEX MODELS OF SEPARATED FLOW PAST A CIRCULAR CONE AT INCIDENCE
Katharine Moore Oct. 1981 38 p refs
(RAE-TM-Aero-1917; BR81702) Copyright. Avail: Issuing Activity

Bryson's simple line-vortex model of laterally symmetric separated flow past a circular cone at incidence, applicable to aircraft or missiles at high angle of attack, was studied numerically and analytically through asymptotic expansions. Two branches of solutions are found: an upper branch which includes Bryson's original results and a lower branch on which the solutions are shown to be physically unrealistic. The physically realistic branch is shown to yield multiple solutions for separation lines to windward of a critical position. A proposed modification to the condition imposed on the flow at the separation line is shown to have little effect on model behavior. Author (ESA)

N82-23191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF LOW-FREQUENCY KERNEL-FUNCTION AERODYNAMICS FOR COMPARISON WITH TIME-DEPENDENT FINITE-DIFFERENCE METHODS
Samuel R. Bland May 1982 29 p refs
(NASA-TM-83283; L-15226; NAS 1.15:83283) Avail: NTIS HC A03/MF A01 CSCL 01A

Finite difference methods for unsteady transonic flow frequency use simplified equations in which certain of the time dependent terms are omitted from the governing equations. Kernel functions are derived for two dimensional subsonic flow, and provide accurate solutions of the linearized potential equation with the same time dependent terms omitted. These solutions make possible a direct evaluation of the finite difference codes for the linear problem. Calculations with two of these low frequency kernel functions verify the accuracy of the LTRAN2 and HYTRAN2 finite difference codes. Comparisons of the low frequency kernel function results with the Possio kernel function solution of the complete linear equations indicate the adequacy of the HYTRAN approximation for frequencies in the range of interest for flutter calculations. S.L.

N82-23192*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A FLIGHT INVESTIGATION OF BLADE-SECTION AERODYNAMICS FOR A HELICOPTER MAIN ROTOR HAVING RC-SC2 AIRFOIL SECTIONS
Charles E. K. Morris, Jr. Mar. 1982 163 p refs
(NASA-TM-83298; NAS 1.15:83298) Avail: NTIS HC A08/MF A01 CSCL 10A

Pressure data at 90 percent blade radius for a helicopter main rotor with RC-SC2 blade sections was obtained. Concurrent measurements were made of vehicle flight state, performance and some rotor loads. The test envelope included hover, level flight from about 65 to 144 knots, climb and descent, and collective fixed maneuvers. Airfoil pressure distributions obtained in flight agree with those theoretical calculations for two dimensional, steady flow. S.L.

N82-23193*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF A TRANSONIC POTENTIAL FLOW CODE TO THE STATIC AEROELASTIC ANALYSIS OF THREE-DIMENSIONAL WINGS
Woodrow Whitlow, Jr. and Robert M. Bennett Apr. 1982 12 p refs Presented at the AIAA/ASME/ASCE/AHS 23rd Struct., Structural Dyn. and Mater. Conf., New Orleans, 10-12 May 1982
(NASA-TM-83296; NAS 1.15:83296; AIAA-PAPER-82-0689)
Avail: NTIS HC A02/MF A01 CSCL 01A

Since the aerodynamic theory is nonlinear, the method requires the coupling of two iterative processes - an aerodynamic analysis and a structural analysis. A full potential analysis code, FLO22, is combined with a linear structural analysis to yield aerodynamic load distributions on and deflections of elastic wings. This method was used to analyze an aeroelastically-scaled wind tunnel model of a proposed executive-jet transport wing and an aeroelastic research wing. The results are compared with the corresponding rigid-wing analyses, and some effects of elasticity on the aerodynamic loading are noted. T.M.

N82-23194*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ACCURATE METHOD FOR EVALUATING THE KERNEL OF THE INTEGRAL EQUATION RELATING LIFT TO DOWNWASH IN UNSTEADY POTENTIAL FLOW
Robert N. Desmarais Apr. 1982 15 p refs Presented at the AIAA/ASME/ASCE/AHS 23rd Struct., Structural Dyn. and Mater. Conf., New Orleans, 10-12 May 1982 10-12 May 1982
(NASA-TM-83281; NAS 1.15:83281; AIAA-PAPER-82-687)
Avail: NTIS HC A02/MF A01 CSCL 01A

The method is capable of generating approximations of arbitrary accuracy. It is based on approximating the algebraic part of the nonelementary integrals in the kernel by exponential functions and then integrating termwise. The exponent spacing in the approximation is a geometric sequence. The coefficients and exponent multiplier of the exponential approximation are computed by least squares so the method is completely automated. Exponential approximates generated in this manner are two orders of magnitude more accurate than the exponential approximation that is currently most often used for this purpose. The method can be used to generate approximations to attain any desired trade-off between accuracy and computing cost. T.M.

N82-23195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATIC AND UNSTEADY PRESSURE MEASUREMENTS ON A 50 DEGREE CLIPPED DELTA WING AT M = 0.9
R. W. Hess, E. C. Wynne, and F. W. Cazier Apr. 1982 10 p refs
(NASA-TM-83297; NAS 1.15:83297) Avail: NTIS HC A02/MF A01 CSCL 01A

Pressures were measured with Freon as the test medium. Data taken at M = 0.9 is presented for static and oscillatory deflections of the trailing edge control surface and for the wing in pitch. Comparisons of the static measured data are made with results computed using the Bailey-Ballhaus small disturbance code. T.M.

N82-23196*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TIME-MARCHING TRANSONIC FLUTTER SOLUTIONS INCLUDING ANGLE-OF-ATTACK EFFECTS
John W. Edwards, Robert M. Bennett, Woodrow Whitlow, Jr., and David A. Seidel Apr. 1982 16 p refs Presented at the AIAA/ASME/ASCE/AHS Struct., Structural Dyn. and Mater. Conf., New Orleans, 10-12 May 1982
(NASA-TM-83295; NAS 1.15:83295; AIAA-PAPER-82-0685)
Avail: NTIS HC A02/MF A01 CSCL 01A

Transonic aeroelastic solutions based upon the transonic small

perturbation potential equation were studied. Time-marching transient solutions of plunging and pitching airfoils were analyzed using a complex exponential modal identification technique, and seven alternative integration techniques for the structural equations were evaluated. The HYTRAN2 code was used to determine transonic flutter boundaries versus Mach number and angle-of-attack for NACA 64A010 and MBB A-3 airfoils. In the code, a monotone differencing method, which eliminates leading edge expansion shocks, is used to solve the potential equation. When the effect of static pitching moment upon the angle-of-attack is included, the MBB A-3 airfoil can have multiple flutter speeds at a given Mach number. T.M.

N82-23197# Aeronautical Research Labs., Melbourne (Australia).
A NUMERICAL INVESTIGATION OF TWO-DIMENSIONAL, SUBSONIC, LINEAR, WIND TUNNEL INTERFERENCE THEORY
N. Pollock Jun. 1981 40 p refs
(ARL/AERO-NOTE-403; AR-002-294) Avail: NTIS HC A03/MF A01

An investigation of two-dimensional, subsonic, linear wind tunnel interference using the computer program TSFOIL as a numerical tunnel was carried out for solid, open, porous and slotted walls. The use of a computer code rather than physical experiment has the advantage that test parameters such as wall characteristics and model chord can be varied widely at low cost. The aim was to determine the relative merits of the various walls and to establish the limits of applicability of linear interference theory. The most favorable wall type was found to be an ideal slotted wall with the slot parameter appropriate for zero solid blockage (F = 1.1844). For this wall type linear interference theory accurately predicted lift and pitching moment corrections for tunnel height to chord ratios greater than 2 and supersonic region height to tunnel height ratios less than 0.2.
Author

N82-23198# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Aeroelastik.
UNSTEADY PRESSURE MEASUREMENTS AT STALL AND BUFFETING
Peter Bublitz Apr. 1979 52 p refs In GERMAN; ENGLISH summary Translation was announced as N81-21041
(DFVLR-Mitt-79-09) Avail: NTIS HC A04/MF A01

The fluid dynamic phenomena of stall and buffeting, as well as the marked effects on elastic structures are described. By applying the generalized form of the equations of motion and the Fourier transforms, the governing equation of the dynamic response problem is concisely derived. Quantities needed to treat the problem under consideration are determined. Then the test installation and the relevant test method are depicted to some extent, in which the direct pressure measuring method and the statistical evaluation method are the main topics. A trapezoidal stalled wing with and without strake are tested. The efficiency of the test procedure is shown and some insight into the dynamic behavior of the stall is provided. S.L.

N82-23199# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
APPROXIMATE METHOD FOR PREDICTING SUPERSONIC NORMAL FORCE COEFFICIENT VERY-LOW-ASPECT-RATIO LIFTING SURFACES
E. F. Lucero 14 May 1981 32 p refs Sponsored in part by NAVSEA 62R
(AD-A111770) Avail: NTIS HC A03/MF A01 CSCL 20/4

A simple, empirical method has been developed for predicting at supersonic speeds the normal force coefficient, C(N), (including carryover) of very-low-aspect ratio lifting surfaces mounted on bodies of revolution. Predicted values of C(N) using this method are shown to be in good agreement with test data obtained on both thick and thin surfaces, at Mach numbers from about 2.5 to 7.7 and angles of attack to 24 degrees. Author (GRA)

N82-23200# Akademische Fliegergruppe Braunschweig (West Germany).
WIND TUNNEL INVESTIGATIONS OF SAILPLANE FUSELAGES WITH DIFFERENT LACINGS AND WING SETTINGS [WINDKANALUNTERSUCHUNGEN AN SEGELFLUGZEUGRUEMPFEN MIT VERSCHIEDENER EINSCHNUERUNG UND FLUEGELANORDNUNG]
Rolf Radespiel 1981 14 p In GERMAN
Avail: NTIS HC A02/MF A01

The parameter fuselage lacing, sailplane wing setting and fuselage nose radius of nine glider configurations were investigated in a wind tunnel. Laminar peeling off blisters were found on strongly laced fuselages. These in the transition between fuselage and wing are essential for the harmful aerodynamic resistance. Resistance reduction was measured for increasing lacing and wing setting in the rear. These results are only valid for undisturbed flow on the fuselage front part, a condition which is not yet fulfilled for original sailplanes. Author (ESA)

N82-23201# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.
THE IMPINGEMENT OF AXISYMMETRIC SUPERSONIC JETS ON CONES Ph.D. Thesis - London Univ.
Ian Kenneth Jennions Oct. 1980 257 p refs
(HTS/80/8) Avail: NTIS HC A13/MF A01

A numerical model for predicting the behavior of steady, two dimensional, transonic flows which have a predominant flow direction is presented. The model includes compressibility effects and the explicit calculation of stagnation pressure losses through normal and oblique shock waves. The governing equations are solved in a streamline coordinate system, using a finite difference procedure which can handle both plane and axisymmetric flows. For supersonic flows, the method produces the results in one sweep of the field, iterations being performed at each section to ensure a converged solution. In subsonic flows pressure effects can propagate upstream, the governing equations are elliptic, and the scheme performs many sweeps of the field in order to allow for this influence. At the interface between supersonic and subsonic flows, special cells are defined and analyzed in order to link the two regions. Author (ESA)

N82-23202# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Mathematische Verfahren und Datentechnik.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE DYNAMIC BEHAVIOR OF PARACHUTE-LOAD SYSTEMS DURING WIND TUNNEL TESTS Ph.D. Thesis - Technischen Univ.
Karl-Friedrich Doherr 30 Jul. 1981 259 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-81-29) Avail: NTIS HC A12/MF A01; DFVLR, Cologne DM 45,30

Payload deceleration and stabilization by small parachutes was numerically treated. Aerodynamic force effects on various parachute models were studied in a wind tunnel, using a load measurement setup with four rotational degrees of freedom. Computerized simulation of observed oscillatory motions was undertaken. The system of nonlinear equations of motion was solved. Simplified nonlinear and linearized cases with reduced degrees of freedom were approximated analytically. Results show that parachute oscillations are excited by unsteady stochastic force components caused by separated vortex flow at the parachute canopy. Aerodynamic data for the different parachute designs are listed. Author (ESA)

N82-23203# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
CALCULATION OF UNSTEADY TRANSONIC FLOWS WITH SHOCKS BY FIELD PANEL METHODS
M. H. L. Hounjet 1 Jul. 1981 14 p refs Submitted for publication; sponsored by Directorate of Material, Royal Netherlands Air Force (RNLAF)
(NLR-MP-81041-U) Avail: NTIS HC A02/MF A01

A field panel method, FTRAN2, for the calculation of two-dimensional inviscid transonic flow, including shock waves about an oscillating wing, is presented. For a NACA 64A006 and a NACA 64A010 airfoil, results are presented and compared with results of finite difference methods. The good agreement obtained and the lower computer cost show the feasibility of the method. A modification of FTRAN2, applicable to three dimensions, and which achieves further reduction of the computational effort is proposed. Results for an oscillating flat plate are satisfactory. Author (ESA)

N82-23204# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

A FIELD PANEL METHOD FOR THE CALCULATION OF INVISCID TRANSONIC FLOW ABOUT THIN OSCILLATING AIRFOILS WITH SHOCKS

M. H. L. Hounjet 10 Sep. 1981 37 p refs Presented at Intern. Symp. on Aeroelasticity, Nuremberg, 5-7 Oct. 1981 Sponsored by Directorate of Materials, Royal Netherlands Air Force (RNLAF)

(NLR-MP-81043-U) Avail: NTIS HC A03/MF A01

A field panel method for two-dimensional flow, based on the solution on an integral equation which combines a subsonic lifting surface panel method with subsonic source panels in the flow is presented. These source panels account for nonuniformities in the velocity distribution due to airfoil thickness and incidence. For an NACA 64A006 and for an NACA 64A010 airfoil, transonic results are presented and compared with results of the LTRAN2-NLR code. The good agreement obtained shows the feasibility of the method. The lower computer cost makes this approach attractive for extension to three-dimensional flow. Author (ESA)

N82-23205# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

A HIGHER-ORDER PANEL METHOD FOR THE COMPUTATION OF THE FLOW ABOUT SLENDER DELTA WINGS WITH LEADING-EDGE VORTEX SEPARATION

H. W. M. Hoeijmakers and W. Vaatstra 7 Oct. 1981 26 p refs Presented at 4th GAMM Conf. on Numerical Methods in Fluids Mech., Paris, 7-9 Oct. 1981

(NLR-MP-81053-U) Avail: NTIS HC A03/MF A01

A second-order panel method for computing the limiting cases of conical flow about delta wings and time dependent two-dimensional development of the wake behind the trailing edge of wings is shown to be stable for the mixed design/analysis boundary conditions, characterizing both problems. The method for following two-dimensional vortex sheet motion includes an adaptive curvature dependent panel scheme and a concept for doubly-branched spiralling vortices, which enables the motion of vortex sheets of complicated shape to be followed up to large downstream distances. Conical flow results for different angles of attack and for different cross-sectional shapes are presented. Vortex sheet roll-up results for the wake behind a flat delta wing are presented. Results compare well with experiment and other model values. Author (ESA)

N82-23206# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

RECENT DEVELOPMENTS IN THE UNSTEADY PRESSURE MEASURING TECHNIQUE

J. J. Horsten 10 Sep. 1981 14 p refs Presented at Intern. Symp. on Aeroelasticity, Nuremburg, 5-7 Oct. 1981 Sponsored by Netherlands Agency for Aerospace Programs

(NLR-MP-81055-U) Avail: NTIS HC A02/MF A01

Pressure measurements at oscillating wind tunnel models using a processor for harmonic analysis of the response of oscillating surfaces, is introduced. This system is essentially a multichannel transfer function analyzer through which 48 channels can be operated simultaneously. The investigation of a two-dimensional 12% thick supercritical wing model oscillating at transonic speeds illustrates the system. A test rig excited the model in a wind tunnel in two pitching modes and a heaving mode. Mach number, frequency, angle of attack, amplitude, and vibration mode were varied. Accuracy and overall measurement time needed to produce quick look results confirm system performance expectations. Author (ESA)

N82-23152# *Advisory Group for Aerospace Research and* Development, Neuilly-Sur-Seine (France).

JET INTERACTIONS WITH NEIGHBORING SURFACES

J. Barche *In* AGARD Fluid Dyn. of Jets with Appl. of V/STOL Jan. 1982 18 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23153# Coimbra Univ. (Portugal). Dept. of Science and Technology.

INTERACTION OF SIMPLE AND MULTIPLE JETS WITH A PLANE SURFACE

A. R. Janeiro Borges (Univ. Nova de Lisboa) and D. X. Viegas *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23154# Laval Univ. (Quebec). Dept. de Genie Mechanique.

THE REATTACHMENT OF TWO JETS ON THEMSELVES [RECOLLEMENT DE DEUX JETS SUR EUX-MEMES]

Claude Bourque *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs In FRENCH (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23155# Instituto Superior Tecnico, Lisbon (Portugal). Dept. of Mechanical Engineering.

JETS IMPINGING NORMALLY AND OBLIQUELY TO A WALL

S. R. B. Araujo, D. F. G. Durao, and F. J. C. Firmino *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 10 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23156# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

AN INVESTIGATION OF INCLINED JETS IN A CROSSWIND

P. Taylor and D. J. Watkins *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs Sponsored in part by SERC (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23157# Louisiana State Univ., Baton Rouge. Dept. of Mechanical Engineering.

AN EXPERIMENTAL INVESTIGATION OF AN UPPER SURFACE BLOWING CONFIGURATION

G. D. Catalano, J. B. Morton, and R. R. Humphris *In* AGARD Fluid Dyn. of Jets with Appl. of V/STOL Jan. 1982 14 p refs Prepared in cooperation with Virginia Univ. (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23158# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Aircraft Div.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE INTERACTION BETWEEN THE ENGINE JET AND THE SURROUNDING FLOW FIELD WITH REGARD TO THE PRESSURE DRAG ON AFTERBODIES

A. Zacharias *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 22 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23159# Ecole Centrale de Lyon (France). Lab. de Mechanique des Fluides.

STRUCTURE AND DEVELOPMENT OF TURBULENT JETS

J. Mathieu and G. Charnay *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 23 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23160# Imperial Coll. of Science and Technology, London *(England). Dept. of Mechanical Engineering.*

A ROW OF JETS IN A CROSSFLOW

Z. A. Khan, J. J. McGuirk, and J. H. Whitelaw *In* AGARD *Fluid Dyn. of Jets with Appl. to V/STOL* Jan. 1982 11 p refs Sponsored in part by Science Research Council and Rolls-Royce Ltd. (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23161# *Queen Mary Coll., London (England).*

EXPERIMENTAL INVESTIGATION OF INITIALLY PLANAR JETS INCLINED TO AN EXTERNAL FLOW

Y. Pontikis, R. A. Feik, and A. D. Young *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)

Avail: NTIS HC A19/MF A01

N82-23162# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RESONANT ENTRAINMENT OF A CONFINED PULSED JET
Pradip G. Parikh *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 10 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23163# Technische Hochschule, Aachen (West Germany). Inst. fuer Luft- und Raumfahrt.
FLOWFIELD AND NOISE SOURCES OF JET IMPINGEMENT OF FLAPS AND GROUND SURFACE
Guenther Neuwerth *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 7 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23164# Trondheim Univ. (Norway). Inst. for Mekanikk.
THE NEAR FIELD OF A PLANE TURBULENT JET
Leif N. Persen *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 18 p refs Sponsored in part by Royal Norwegian Council for Scientific and Industrial Research (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23165*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
JET V/STOL WIND-TUNNEL SIMULATION AND GROUND-PLANE EFFECTS
Richard J. Margason *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 21 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

N82-23166*# McDonnell-Douglas Corp., St. Louis, Mo. Aerodynamics Dept.
THE MODELING AND PREDICTION OF MULTIPLE JET VTOL AIRCRAFT FLOW FIELDS IN GROUND EFFECT
Donald R. Kotansky *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 20 p refs (For primary document see N82-23150 14-01)
(Contracts NAS2-9646; NAS2-10184; N62269-76-C-0086; N00014-79-C-0130)
Avail: NTIS HC A19/MF A01 CSCL 01A

N82-23173# Societe Bertin et Cie, Plaisir (France).
EXPERIMENTAL STUDY OF A JET DEFLECTOR [ETUDE EXPERIMENTALE D'UN DEVIATEUR DE JET]
M. Lepretre and C. Portier *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 20 p refs In FRENCH; ENGLISH summary Sponsored in part by Delegation Generale pour l'Armement (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23177# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
PREDICTION OF PROPULSION INDUCED EFFECTS IN TRANSITION USING A MODIFIED JET WAKE MODEL
M. M. Walters and K. T. Yen *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N82-23207*# Boeing Commercial Airplane Co., Seattle, Wash.
COMMERCIAL JET TRANSPORT CRASHWORTHINESS
E. Widmayer and Otto B. Brende Apr. 1982 255 p refs (Contract NAS1-16076)
(NASA-CR-165849; NAS 1.26:165849; DOT-FAA-CT-82-86)
Avail: NTIS HC A12/MF A01 CSCL 01C

The results of a study to identify areas of research and approaches that may result in improved occupant survivability and crashworthiness of transport aircraft are given. The study defines areas of structural crashworthiness for transport aircraft which might form the basis for a research program. A 10-year research and development program to improve the structural impact resistance of general aviation and commercial jet transport aircraft is planned. As part of this program parallel studies were conducted to review the accident experience of commercial transport aircraft, assess the accident performance of structural components and the status of impact resistance technology, and recommend areas of research and development for that 10-year plan. The results of that study are also given. R.J.F.

N82-23208*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HELICOPTER HANDLING QUALITIES
Apr. 1982 243 p refs Proceedings of the special meeting held at Moffett Field, Calif., 14-15 Apr. 1982; sponsored by the American Helicopter Society
(NASA-CP-2219; A-8891; NAS 1.55:2219) Avail: NTIS HC A11/MF A01 CSCL 01C

Helicopters are used by the military and civilian communities for a variety of tasks and must be capable of operating in poor weather conditions and at night. Accompanying extended helicopter operations is a significant increase in pilot workload and a need for better handling qualities. An overview of the status and problems in the development and specification of helicopter handling-qualities criteria is presented. Topics for future research efforts by government and industry are highlighted. For individual titles, see N82-23209 through N82-23230.

N82-23209*# Naval Air Development Center, Warminster, Pa.
VTOL AND VSTOL HANDLING QUALITIES SPECIFICATIONS, AN OVERVIEW OF THE CURRENT STATUS
Kevin W. Goldstein *In* NASA, Ames Research Center Helicopter Handling Qualities Apr. 1982 p 1-7 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The highlights of a comparative analysis between the current helicopter and VSTOL specifications and four representative rotary wing aircraft are presented. Longitudinal, lateral, and directional control power and dynamic stability characteristics were analyzed for hovering conditions. Forward flight static and dynamic stability were analyzed for the longitudinal and lateral-directional axes. Results of the analyses in terms of the applicability/utility of the MIL-H-8501A criteria are presented for each of the above areas. The review of the MIL-H-8301A criteria against those in MIL-F-83300 and AGARD 577 indicate many areas in which MIL-H-8501A does not give adequate design guidance. T.M.

N82-23210*# Aerospatiale Helicopter Corp., Grand Prairie, Tex.
CIVIL (FRENCH/US) CERTIFICATION OF THE COAST GUARD'S HH-65A DAUPHIN
J. C. Hart, J. M. Besse (Societe Nationale Industrielle Aerospatiale, Marignane, France), and K. W. McElreath (Rockwell Collins Government Avionics Div., Cedar Rapids, Iowa) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 9-13 (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

Certification programs with particular emphasis on handling qualities requirements are described. A dynamic simulator was designed and constructed to support and verify the dynamic aspects of the avionics system, particularly the Automatic Flight Control System (AFCS). The role of the Dynamic Simulator is discussed. T.M.

N82-23211*# Boeing Vertol Co., Philadelphia, Pa.
BOEING 234 FLIGHT CONTROL DEVELOPMENT
James J. Morris *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 15-22 (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The Boeing 234 is the commercially certified derivative of

the CH-47 Chinook. The automatic flight control system and flight director with coupler were designed to reduce pilot work-load for missions of approximately six hour duration during VFR, IFR, day and night conditions. The AFCS system for the 234 is essentially the same system as developed for the CH-47D, which has airspeed hold, attitude hold, and maneuver enhancement in all three axes. The system also has the capability to couple to the Sperry Helcis flight director system which provides for enroute navigation and landing approaches. Certification testing was completed, by both the FAA and CAA, to FAR Part 29 for Transport Category Rotorcraft and BCAR Section G: Rotorcraft. The aircraft was certified for civil operation in June 1981.

Author

N82-23212*# Grumman Aerospace Corp., Bethpage, N.Y.

INFLUENCE OF MANEUVERABILITY ON HELICOPTER COMBAT EFFECTIVENESS

Michael Falco and Roger Smith (Army Aviation Research and Development Command, St. Louis, Mo.) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 23-33 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

A computational procedure employing a stochastic learning method in conjunction with dynamic simulation of helicopter flight and weapon system operation was used to derive helicopter maneuvering strategies. The derived strategies maximize either survival or kill probability and are in the form of a feedback control based upon threat visual or warning system cues. Maneuverability parameters implicit in the strategy development include maximum longitudinal acceleration and deceleration, maximum sustained and transient load factor turn rate at forward speed, and maximum pedal turn rate and lateral acceleration at hover. Results are presented in terms of probability of skill for all combat initial conditions for two threat categories. T.M.

N82-23213*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

FLIGHT TESTS FOR THE ASSESSMENT OF TASK PERFORMANCE AND CONTROL ACTIVITY

Heinz-Juergen Pausder and Dieter Hummes *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 35-46 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

The tests were performed with the helicopters BO 105 and UH-1D. Closely connected with tactical demands the six test pilots' task was to minimize the time and the altitude over the obstacles. The data reduction yields statistical evaluation parameters describing the control activity of the pilots and the achieved task performance. The results are shown in form of evaluation diagrams. Additionally dolphin tests with varied control strategy were performed to get more insight into the influence of control techniques. From these test results recommendations can be derived to emphasize the direct force control and to reduce the collective to pitch crosscoupling for the dolphin. T.M.

N82-23214*# Army Research and Technology Labs., Moffett Field, Calif.

A HELICOPTER HANDLING-QUALITIES STUDY OF THE EFFECTS OF ENGINE RESPONSE CHARACTERISTICS, HEIGHT-CONTROL DYNAMICS, AND EXCESS POWER ON NAP-OF-THE-EARTH OPERATIONS

Lloyd D. Corliss *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 47-57 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

The helicopter configuration with an rpm-governed gas-turbine engine was examined. A wide range of engine response time, vehicle damping and sensitivity, and excess power levels was studied. The data are compared with the existing handling-qualities specifications, MIL-F-83300 and AGARD 577, and in general show a need for higher minimums when performing such NOE maneuvers as a dolphin and bob-up task. T.M.

N82-23215*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNIFIED RESULTS OF SEVERAL ANALYTICAL AND EXPERIMENTAL STUDIES OF HELICOPTER HANDLING QUALITIES IN VISUAL TERRAIN FLIGHT

Robert T. N. Chen *In its* Helicopter Handling Qualities Apr. 1982 p 59-74 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

The studies were undertaken to investigate the effects of rotor design parameters, interaxis coupling, and various levels of stability and control augmentation on the flying qualities of helicopters performing low-level, terrain-flying tasks in visual meteorological conditions. Some unified results are presented, and the validity and limitations of the flying-qualities data obtained are interpreted. Selected results, related to various design parameters, provide guidelines for the preliminary design of rotor systems and aircraft augmentation systems. T.M.

N82-23216*# Boeing Vertol Co., Philadelphia, Pa.

AN ASSESSMENT OF VARIOUS SIDE-STICK CONTROLLER/STABILITY AND CONTROL AUGMENTATION SYSTEMS FOR NIGHT NAP-OF-EARTH FLIGHT USING PILOTED SIMULATION

Kenneth H. Landis and Edwin W. Aiken (Army Research and Technology Labs., Moffett Field, Calif.) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 75-96 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

Several night nap-of-the-earth mission tasks were evaluated using a helmet-mounted display which provided a limited field-of-view image with superimposed flight control symbology. A wide range of stability and control augmentation designs was investigated. Variations in controller force-deflection characteristics and the number of axes controlled through an integrated side-stick controller were studied. In general, a small displacement controller is preferred over a stiffstick controller particularly for maneuvering flight. Higher levels of stability augmentation were required for IMC tasks to provide handling qualities comparable to those achieved for the same tasks conducted under simulated visual flight conditions. T.M.

N82-23217*# Martin Marietta Corp., Orlando, Fla.

DEFINITION OF DISPLAY/CONTROL REQUIREMENTS FOR ASSAULT TRANSPORT NIGHT/ADVERSE WEATHER CAPABILITY

R. Joseph Milelli, Gary W. Mowery, and Carmen Pontelandolfo (Naval Air Development Center, Warminister, Pa.) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 97-107 refs (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

A Helicopter Night Vision System was developed to improve low-altitude night and/or adverse weather assult transport capabilities. Man-in-the-loop simulation experiments were performed to define the minimum display and control requirements for the assult transport mission and investigate forward looking infrared sensor requirements, along with alternative displays such as panel mounted displays (PMD) helmet mounted displays (HMD), and integrated control display units. Also explored were navigation requirements, pilot/copilot interaction, and overall cockpit arrangement. Pilot use of an HMD and copilot use of a PMD appear as both the preferred and most effective night navigation combination. M.D.K.

N82-23218*# National Research Council of Canada, Ottawa (Ontario). Airborne Simulator Facility.

SOME PILOTING EXPERIENCES WITH MULTIFUNCTION ISOMETRIC SIDE-ARM CONTROLLERS IN A HELICOPTER

J. Murray Morgan *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 109-119 ref (For primary document see N82-23208 14-03)

Avail: NTIS HC A11/MF A01 CSCL 01C

The installation of two side-arm mounted, isometric controllers in the NAE Airborne Simulator, a modified, variable stability Bell 205 A is described, as is the development of various control systems for use with them. The results of two experiments are presented indicating both the feasibility and acceptability of such systems for a wide variety of tasks in a conventional single rotor helicopter, with a minimum of stability augmentation. Areas of future research are indicated. Author

N82-23219*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESULTS OF NASA/FAA GROUND AND FLIGHT SIMULATION EXPERIMENTS CONCERNING HELICOPTER IFR AIRWORTHINESS CRITERIA
J. Victor Lebacqz, Robert T. N. Chen, Ronald M. Gerdes, Jeanine M. Weber, and Raymond D. Forrest (FAA, Moffett Field, Calif.) *In its* Helicopter Handling Qualities 1 Apr. 1982 p 121-138 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

A sequence of ground and flight simulation experiments was conducted to investigate helicopter instrument-flight-rules airworthiness criteria. The first six of these experiments and major results are summarized. Five of the experiments were conducted on large-amplitude motion base simulators. The NASA-Army V/STOLAND UH-1H variable-stability helicopter was used in the flight experiment. Artificial stability and control augmentation, longitudinal and lateral control, and in pitch and roll attitude augmentation were investigated. M.D.K.

N82-23220*# Rockwell International Corp., Cedar Rapids, Iowa. Government Avionics Div.
STATE-OF-THE-ART COCKPIT DESIGN FOR THE HH-65A HELICOPTERS
Daniel E. Castleberry and Marsha Y. McElreath *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 139-143 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

In the design of a HH-65A helicopter cockpit, advanced integrated electronics systems technology was employed to achieve several important goals for this multimission aircraft. They were: (1) integrated systems operation with consistent and simplified cockpit procedures; (2) mission-task-related cockpit displays and controls, and (3) reduced pilot instrument scan effort with excellent outside visibility. The integrated avionics system was implemented to depend heavily upon distributed but complementary processing, multiplex digital bus technology, and multifunction CRT controls and displays. This avionics system was completely flight tested and will soon enter operational service with the Coast Guard. M.D.K.

N82-23221*# Ohio State Univ., Columbus.
PERFORMANCE EVALUATION OF A KINESTHETIC-TACTUAL DISPLAY
Richard J. Jagacinski, John M. Flach, Richard D. Gilson, and Richard S. Dunn (Army Research and Technology Lab., Moffett Field, Calif.) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 145-150 refs (For primary document see N82-23208 14-03)
(Grant NsG-2179)
Avail: NTIS HC A11/MF A01 CSCL 01C

Simulator studies demonstrated the feasibility of using kinesthetic-tactual (KT) displays for providing collective and cyclic command information, and suggested that KT displays may increase pilot workload capability. A dual-axis laboratory tracking task suggested that beyond reduction in visual scanning, there may be additional sensory or cognitive benefits to the use of multiple sensory modalities. Single-axis laboratory tracking tasks revealed performance with a quickened KT display to be equivalent to performance with a quickened visual display for a low frequency sum-of-sinewaves input. In contrast, an unquickened KT display was inferior to an unquickened visual display. Full scale simulator studies and/or inflight testing are recommended to determine the generality of these results. Author

N82-23222*# Army Avionics Research and Development Activity, Fort Monmouth, N. J. Avionics Lab.
SYNTHESIS OF AN INTEGRATED COCKPIT MANAGEMENT SYSTEM
Joseph A. Dasaro and Charles T. Elliott *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 151-162 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The process used in the synthesis of an integrated cockpit management system was discussed. Areas covered included flight displays, subsystem management, checklists, and procedures (both normal and emergency). The process of evolving from the unintegrated conventional system to the integrated system is examined and a brief description of the results presented. M.D.K.

N82-23223*# United Technologies Corp., East Hartford, Conn. Aircraft Div.
THE ROLE OF VOICE TECHNOLOGY IN ADVANCED HELICOPTER COCKPITS
Howard P. Harper *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 163-170 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The status of voice output and voice recognition technology in relation to helicopter cockpit applications is described. The maturing of this technology provides many opportunities for new approaches to crew workload reduction. The helicopter operating environment, potential application areas, and the impact on advanced cockpit design are discussed. Author

N82-23224*# Pacer Systems, Inc., Arlington, Va.
COCKPIT INTEGRATION FROM A PILOT'S POINT OF VIEW
David L. Green *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 171-181 (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

Extensive experience in both operational and engineering test flight was used to suggest straightforward changes to helicopter cockpit and control system design that would improve pilot performance in marginal and instrument flight conditions. Needed control system improvements considered include: (1) separation of yaw from cyclic force trim; (2) pedal force proportional to displacement rate; and (3) integration of engine controls in collective stick. Display improvements needed include: (1) natural cuing of yaw rate in attitude indicator; (2) collective position indication and radar altimeter placed within primary scan; and (3) omnidirectional display of full range airspeed data. M.D.K.

N82-23225*# Costruzioni Aeronautiche Giovanni Agusta S.p.A., Samarate (Italy). Helicopter Systems Engineering Div.
INTEGRATED COCKPIT FOR A-129
Filippo Reina, James J. Gracia (Harris Government Information Systems Div.), and Bryce W. Koth (Harris Government Information Systems Div.) *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 183-192 (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01

Weight, size, and mission requirements for the A-129 mandated an integrated system approach for the crew/cockpit interface design. Instead of the usual multitude of cockpit controls, indicators, gauges, and lights, the primary crew interface is a single multifunction keyboard and one or more multifunction CRT display units. This cockpit design approach imposed unusual constraints upon the system architecture to overcome the inherent information access limitations of a data input/output window that was restricted by the available space. The conceptual approach and resulting design of the A-129 cockpit with the intent to enhance the development of cockpit standardization are described. Author

N82-23226*# Systems Technology, Inc., Hawthorne, Calif.
NEW DEVELOPMENT IN FLYING QUALITIES WITH APPLICATION TO ROTARY WING AIRCRAFT
Roger H. Hoh *In* NASA. Ames Research Center Helicopter Handling Qualities 9 Apr. 1982 p 193-198 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

Some recent considerations and developments in handling quality criteria are reviewed with emphasis on using fixed wing experience gained in developing MIL-F-8785C and the more recent MIL Standard and Handbook. Particular emphasis is placed on the tasks and environmental conditions used to develop the criterion boundaries, SAS failures, and potential fixed wing criteria that are applicable to rotary wing aircraft. Author

N82-23227*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HELICOPTER SIMULATION TECHNOLOGY: AN AMES RESEARCH CENTER PERSPECTIVE

Richard S. Bray *In its* Helicopter Handling Qualities Apr. 1982 p 199-208 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The total experience for evidence regarding the levels of motion and visual cueing fidelity required for handling-qualities research in ground-based simulators is reviewed. Positive contributions of cockpit motion were identified, but much remains to be learned regarding the sensitivities of individual control modes to cueing attenuation. A firmer understanding of the pilot's utilization of visual and motion cues is the key to more efficient use of simulation in helicopter control-systems research. Author

N82-23228*# Stanford Univ., Calif. Joint Inst. of Aeronautics and Acoustics.
PAST APPLICATIONS AND FUTURE POTENTIAL OF VARIABLE STABILITY RESEARCH HELICOPTERS
William S. Hindson *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 209-219 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

The historical development of variable-stability research helicopters and some of their previous applications are presented as a guide for assessing their future potential. The features of three general-purpose rotary-wing flight research aircraft that provide complementary capabilities are described briefly, and a number of future applications are proposed. Author

N82-23229*# Systems Technology, Inc., Mountain View, Calif.
A PILOT IN THE LOOP ANALYSIS OF HELICOPTER ACCELERATION/DECELERATION MANEUVERS
Robert K. Heffley *In* NASA. Ames Research Center Helicopter Handling Qualities Apr. 1982 p 221-232 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

Helicopter flight acceleration/deceleration maneuvers are quantified and put to use in the fields of handling qualities, flight training and evaluation of simulator fidelity. The three specific cases include the normal speed change maneuver, the nap-of-the-Earth dash/quickstop, and the decelerating approach to hover. All of these maneuvers share common generic features in terms of pilot adaptation and mathematical description; yet each differs in terms of the essential feedback loop structure, implications for handling qualities requirements, and simulator fidelity criteria. Author

N82-23230*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
APPLICATIONS OF SYSTEM IDENTIFICATION METHODS TO THE PREDICTION OF HELICOPTER STABILITY, CONTROL AND HANDLING CHARACTERISTICS
G. D. Padfield (RAE, Bedford, England) and R. K. DuVal *In its* Helicopter Handling Qualities Apr. 1982 p 233-247 refs (For primary document see N82-23208 14-03)
Avail: NTIS HC A11/MF A01 CSCL 01C

A set of results on rotorcraft system identification is described. Flight measurements collected on an experimental Puma helicopter are reviewed and some notable characteristics highlighted. Following a brief review of previous work in rotorcraft system identification, the results of state estimation and model structure estimation processes applied to the Puma data are presented. The results, which were obtained using NASA developed software, are compared with theoretical predictions of roll, yaw and pitching moment derivatives for a 6 degree of freedom model structure. Anomalies are reported. The theoretical methods used are described. A framework for reduced order modelling is outlined. Author

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N82-23231* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SUN SENSING GUIDANCE SYSTEM FOR HIGH ALTITUDE AIRCRAFT Patent
Robert D. Reed, Principal Investigator Issued 27 Apr. 1982 7 p Filed 12 Mar. 1980 Supersedes N80-20249 (18 - 11, p 1375)
(NASA-Case-FRC-11052-1; US-Patent-4,326,685; US-Patent-Appl-SN-129783; US-Patent-Class-244-175; US-Patent-Class-244-168; US-Patent-Class-244-190; US-Patent-Class-318-580) Avail: US Patent and Trademark Office CSCL 17G

A sun sensing guidance system for high altitude aircraft is described. The system is characterized by a disk shaped body mounted for rotation aboard the aircraft in exposed relation to solar radiation. The system also has a plurality of mutually isolated chambers; each chamber being characterized by an opening having a photosensor disposed therein and arranged in facing relation with the opening for receiving incident solar radiation and responsively providing a voltage output. Photosensors are connected in paired relation through a bridge circuit for providing heading error signals in response to detected imbalances in intensities of solar radiation.

Official Gazette of the U.S. Patent and Trademark Office

N82-23232# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dyanamik der Flugsysteme.
COLORED MEASUREMENT NOISE DIGITAL PREFILTERING BY AVERAGING
Rainer Froriep Jul. 1979 40 p refs In GERMAN; ENGLISH summary Translation was announced as N81-21057
(DFVLR-Mitt-79-08) Avail: NTIS HC A03/MF A01

The fast initial fine alignment of an inertial platform with a Kalman filter is accelerated by a digital prefilter. The digital prefilter has the task of averaging a batch of sampled measurement data with correlated noise. The developed prefilter is characterized by little computational burden and little storage requirements, which is independent of the number of prefiltered measurement data. Therefore a very high data rate is possible. The choice of filter parameters is discussed by means of simulation results. The filter algorithm is illustrated step by step and is completely (on-line and off-line) presented. S.L.

N82-23233*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS AND MONTE CARLO SIMULATION OF NEAR-TERMINAL AIRCRAFT FLIGHT PATHS
James R. Schiess and Christine G. Matthews (Computer Sciences Corp.) Apr. 1982 39 p refs
(NASA-TP-1997; L-15062; NAS 1.60:1997) Avail: NTIS HC A03/MF A01 CSCL 17G

The flight paths of arriving and departing aircraft at an airport are stochastically represented. Radar data of the aircraft movements are used to decompose the flight paths into linear and curvilinear segments. Variables which describe the segments are derived, and the best fitting probability distributions of the variables, based on a sample of flight paths, are found. Conversely, given information on the probability distribution of the variables, generation of a random sample of flight paths in a Monte Carlo simulation is discussed. Actual flight paths at Dulles International Airport are analyzed and simulated. S.L.

N82-23183# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
INTEGRATED NAVIGATION-TF/TA-SYSTEM BASED ON STORED TERRAIN DATA PROCESSING

Horst-Dieter Lerche *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 13 p (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

N82-23184# Societe d'Applications Generales d'Electricite et de Mecanique, Paris (France).
OPTIMAL INERTIAL NAVIGATION USING TERRAIN CORRELATION: AN ATTRACTIVE SOLUTION TO THE GROUND ATTACK AIRCRAFT NAVIGATION PROBLEM
L. Camberlein, M. deCremiers, and D. Chermette *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 15 p In FRENCH; ENGLISH summary (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N82-23234*# Lockheed-Georgia Co., Marietta.
DETERMINATION OF WIND TUNNEL CONSTRAINT EFFECTS BY A UNIFIED PRESSURE SIGNATURE METHOD. PART 1: APPLICATIONS TO WINGED CONFIGURATIONS Final Report, Oct. 1980 - Nov. 1981
J. E. Hackett, S. Sampath, and C. G. Phillips Jun. 1981 185 p refs 2 Vol.
(Contract NAS2-9883)
(NASA-CR-166186; NAS 1.26:166186; LG81ER0166-Pt-1)
Avail: NTIS HC A09/MF A01 CSCL 01C

A new, fast, non-iterative version of the 'Wall Pressure Signature Method' is described and used to determine blockage and angle-of-attack wind tunnel corrections for highly-powered jet-flap models. The correction method is complemented by the application of tangential blowing at the tunnel floor to suppress flow breakdown there, using feedback from measured floor pressures. This tangential blowing technique was substantiated by subsequent flow investigations using an LV. The basic tests on an unswept, knee-blown, jet flapped wing were supplemented to include the effects of slat-removal, sweep and the addition of unflapped tips. C sub mu values were varied from 0 to 10 free-air C sub l's in excess of 18 were measured in some cases. Application of the new methods yielded corrected data which agreed with corresponding large tunnel 'free air' resuls to within the limits of experimental accuracy in almost all cases. A program listing is provided, with sample cases. Author

N82-23235*# Lockheed-Georgia Co., Marietta.
DETERMINATION OF WIND TUNNEL CONSTRAINT EFFECTS BY A UNIFIED PRESSURE SIGNATURE METHOD. PART 2: APPLICATION TO JET-IN-CROSSFLOW Final Report, Oct. 1980 - Nov. 1981
J. E. Hackett, S. Sampath, and C. G. Phillips Jun. 1981 186 p refs 2 Vol.
(Contract NAS2-9883)
(NASA-CR-166187; NAS 1.26:166187; LG81ER0167-Pt-2)
Avail: NTIS HC A09/MF A01 CSCL 01C

The development of an improved jet-in-crossflow model for estimating wind tunnel blockage and angle-of-attack interference is described. Experiments showed that the simpler existing models fall seriously short of representing far-field flows properly. A new, vortex-source-doublet (VSD) model was therefore developed which employs curved trajectories and experimentally-based singularity strengths. The new model is consistent with existing and new experimental data and it predicts tunnel wall (i.e. far-field) pressures properly. It is implemented as a preprocessor to the wall-pressure-signature-based tunnel interference predictor. The supporting experiments and theoretical studies revealed some new results. Comparative flow field measurements with 1-inch 'free-air' and 3-inch impinging jets showed that vortex penetration into the flow, in diameters, was almost unaltered until 'hard' impingement occurred. In modeling impinging cases, a 'plume redirection' term was introduced which is apparently absent in previous models. The effects of this term were found to be very significant. Author

N82-23236*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF ANALYTICAL PREDICTIONS OF LONGITUDINAL SHORT PERIOD PILOT-INDUCED OSCILLATIONS WITH RESULTS FROM A SIMULATION STUDY OF THE SPACE SHUTTLE ORBITER
Donald R. Riley and G. Kimball Miller, Jr. Apr. 1982 43 p refs
(NASA-TM-83267; L-14847; NAS 1.15:83267) Avail: NTIS HC A03/MF A01 CSCL 01C

An analytical analysis of conditions producing pilot induced oscillations (PIO's) was made for the space shuttle orbiter in a landing approach configuration for the task of milling the elevation angle of the line of sight to a target vehicle. The analysis yielded a value of PIO frequency and a value for the amount of total system time delay (pilot + control system) that can be tolerated before instability results. Calculations were performed showing the effect of varying the range to the target and of varying the handling qualities of the orbiter vehicle. Analytical predictions were compared with simulation results obtained using a visual motion simulator. Author

N82-23237*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VALIDATION OF ZERO-ORDER FEEDBACK STRATEGIES FOR MEDIUM RANGE AIR-TO-AIR INTERCEPTION IN A HORIZONTAL PLANE
Josef Shinar Apr. 1982 48 p refs
(NASA-TM-84237; NAS 1.15:84237; A-8895) Avail: NTIS HC A03/MF A01 CSCL 01C

A zero order feedback solution of a variable speed interception game between two aircraft in the horizontal plane, obtained by using the method of forced singular perturbation (FSP), is compared with the exact open loop solution. The comparison indicates that for initial distances of separation larger than eight turning radii of the evader, the accuracy of the feedback approximation is better than one percent. The result validates the zero order FSP approximation for medium range air combat analysis. S.L.

N82-23238*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
AUTOMATED DESIGN OF MINIMUM DRAG LIGHT AIRCRAFT FUSELAGES AND NACELLES Final Report
Frederick O. Smetana, Star R. Fox, and Baruch E. Karlin 14 May 1982 25 p refs
(Grant NsG-1584)
(NASA-CR-168913; NAS 1.26:168913) Avail: NTIS HC A02/MF A01 CSCL 01C

The constrained minimization algorithm of Vanderplaats is applied to the problem of designing minimum drag faired bodies such as fuselages and nacelles. Body drag is computed by a variation of the Hess-Smith code. This variation includes a boundary layer computation. The encased payload provides arbitrary geometric constraints, specified a priori by the designer, below which the fairing cannot shrink. The optimization may include engine cooling air flows entering and exhausting through specific port locations on the body. M.D.K.

N82-23239*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRANSONIC FLUTTER STUDY OF A WIND-TUNNEL MODEL OF A SUPERCRITICAL WING WITH/WITHOUT WINGLET
Charles L. Ruhlin, Frank J. Rauch, Jr., and Catherine Waters Mar. 1982 11 p refs Presented at the 23rd AIAA/ASME/ASCE/AHS Struct., Structural Dyn. and Mater. Conf., New Orlean, 10-12 May 1982 Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N.Y.
(NASA-TM-83279; NAS 1.15:83279) Avail: NTIS HC A02/MF A01 CSCL 01C

The model was a 1/6.5-size, semipan version of a wing proposed for an executive-jet-transport airplane. The model was tested with a normal wingtip, a wingtip with winglet, and a normal wingtip ballasted to simulate the winglet mass proper-

ties. Flutter and aerodynamic data were acquired at Mach numbers (M) from 0.6 to 0.95. The measured transonic flutter speed boundary for each wingtip configuration had roughly the same shape with a minimum flutter speed near M = 0.82. The winglet addition and wingtip mass ballast decreased the wing flutter speed by about 7 and 5 percent, respectively; thus, the winglet effect on flutter was more a mass effect than an aerodynamic effect. T.M.

N82-23240*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF FOUR SUBCRITICAL RESPONSE METHODS FOR ON-LINE PREDICTION FLUTTER ONSET IN WIND-TUNNEL TESTS
Charles L. Ruhlin, Judith J. Watson, Rodney H. Ricketts, and Robert V. Doggett, Jr. Mar. 1982 10 p refs Presented at the AIAA/ASME/ASCE/AHS 23rd Struct., Structural Dyn. and Mater. Conf., New Orleans, 10-12 May 1982
(NASA-TM-83278; NAS 1.15:83278; AIAA-PAPER-82-0644CP) Avail: NTIS HC A02/MF A01 CSCL 01C

The methods were evaluated for use in tests where the flutter model is excited solely by airstream turbulence. The methods were: randomdec, power-spectral-density, peak-hold, and cross-spectrum. The test procedure was to maintain a constant Mach number (M) and increase the dynamic pressure (g) in incremental steps. The test Mach numbers were 0.65, 0.75, 0.82, 0.90, and 1.15. The four methods provided damping trends by which the flutter mode could be tracked and extrapolated to a flutter-onset q. A hard flutter point was obtained at M = 0.82. The peak-hold and cross-spectrum methods gave reliable results and could be most readily used for on-line testing. At M = 0.82, a p-k analysis predicted the same flutter mode as the experiment but a 6-percent lower flutter q. At the subcritical dynamic pressures, calculated damping values were appreciably lower than measured data. T.M.

N82-23241*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA/HAA ADVANCED ROTORCRAFT TECHNOLOGY AND TILT ROTOR WORKSHOP. VOLUME 5: PROPULSION SESSION
1980 211 p Workshop held at Palo Alto, Calif., 3-5 Dec. 1980
(NASA-TM-84207; NAS 1.15:84207) Avail: NTIS HC A10/MF A01 CSCL 01C

The expressed needs and priorities of the civil helicopter users, the existing research efforts, and technology requirements as perceived by leading airframe and engine manufacturers were addressed, compared, and evaluated. Specifically, the observations and conclusions of these areas as they relate to the helicopter propulsion system are reported. Author

N82-23242*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/HAA ADVANCED ROTORCRAFT TECHNOLOGY AND TILT ROTOR WORKSHOP. VOLUME 6: VEHICLE CONFIGURATION SESSION
1980 256 p Workshop held at Palo Alto, Calif., 2-5 Dec. 1980
(NASA-TM-84180; NAS 1.15:84180) Avail: NTIS HC A12/MF A01 CSCL 01C

Five high speed rotorcraft configurations are considered: the high speed helicopter, compound helicopter, ABC, tilt rotor and the X wing. The technology requirements and the recommended actions are discussed. S.L.

N82-23243*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/HAA ADVANCED ROTORCRAFT TECHNOLOGY AND TILT ROTOR WORKSHOP. VOLUME 7: TILT ROTOR SESSION
1980 37 p Workshop held at Palo Alto, Calif., 2-5 Dec. 1980
(NASA-TM-84705; NAS 1.15:84705) Avail: NTIS HC A03/MF A01 CSCL 01C

The technical characteristics of the XV-15 aircraft were discussed. Program objectives, concept evaluation, tilt rotor experiments and civil market applications are presented. The XV-15 status and test schedule are also included. S.L.

N82-23244*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PLANAR EQUATIONS OF ROLLOUT MOTION FOR AN AIRCRAFT WITH FREE OR STEERABLE LANDING GEARS
Robert K. Sleeper and Eunice G. Smith May 1982 54 p refs
(NASA-TP-1984; L-11689; NAS 1.60:1984) Avail: NTIS HC A04/MF A01 CSCL 01C

Equations were derived for an aircraft in a three-point attitude. Transient tire forces were simulated by delaying the application of forces derived from steady-state considerations. Predicted rollout trajectories were similar to those measured in tests of a small-scale landing-gear model equipped with pneumatic tires (where a laterally sloping runway was used to simulate a crosswind), both with and without nose-wheel steering. T.M.

N82-23151# Surrey Univ., Guildford (England). Dept. of Mechanical Engineering.
SOME ASPECTS OF JET DYNAMICS AND THEIR IMPLICATIONS FOR VTOL RESEARCH
L. J. S. Bradbury *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 26 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23167# Grumman Aerospace Corp., Bethpage, N.Y.
EVALUATION OF THE EFFECTS OF MODEL SCALE AND TEST TECHNIQUE ON JET-INDUCED EFFECTS
Stanley G. Kalemaris *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 11 p (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23168# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
JET EFFECTS ON FORCES AND MOMENTS OF A VSTOL FIGHTER TYPE AIRCRAFT
B. Haftmann *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23187# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Plans and Management Information Dept.
PRODUCTION VERIFICATION TESTING (PVT) OF GUIDANCE AND CONTROL SYSTEMS FOR HIGH RELIABILITY
Paul J. Logus *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 11 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N82-23245*# Kansas Univ. Center for Research, Inc., Lawrence.
DEVELOPMENT OF A SIMPLE, SELF-CONTAINED FLIGHT TEST DATA ACQUISITION SYSTEM Progress Report
Robert Clarke, Douglas Shane, Jan Roskam, and Dale I. Rummer Apr. 1982 250 p refs
(Grant NsG-4019)
(NASA-CR-168912; NAS 1.26:168912; KU-FRL-407-7) Avail: NTIS HC A11/MF A01 CSCL 14B

The flight test system described combines state-of-the-art microprocessor technology and high accuracy instrumentation with parameter identification technology which minimize data and flight time requirements. The system was designed to avoid permanent modifications of the test airplane and allow quick installation. It is capable of longitudinal and lateral-directional stability and control derivative estimation. Details of this system, calibration and flight test procedures, and the results of the Cessna 172 flight

test program are presented. The system proved easy to install, simple to operate, and capable of accurate estimation of stability and control parameters in the Cessna 172 flight tests. Author

N82-23186# Singer Co., Wayne, N. J.
THE INTEGRATION OF MULTIPLE AVIONIC SENSORS AND TECHNOLOGIES FOR FUTURE MILITARY HELICOPTERS
Albert J. Shapiro *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 21 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N82-23246*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
COMPUTER MODELING OF FAN-EXIT-SPLITTER SPACING EFFECTS ON F100 RESPONSE TO DISTORTION Final Report
M. Shaw and R. W. Murdoch Mar. 1982 115 p refs
(Contract NAS3-22739)
(NASA-CR-167879; NAS 1.26:167879; FR-15596) Avail: NTIS HC A06/MF A01 CSCL 21E

The distortion response of the F100(3) engine was effected by the fan exit splitter configuration. The sensitivity for a proximate splitter fan is calculated to be slightly greater than a remote splitter configuration with identical airfoils. Predicted response was based upon a multiple segment parallel compressor Model modified to include a bypass ratio representation that effects the performance characteristics of the last rotor and intermediate case struts. The predicted distortion response required an accurate definition of row pre- and post-stall undistorted operation. Author

N82-23247*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ALTERNATIVES FOR JET ENGINE CONTROL Technical Progress Report, 1 Oct. 1980 - 30 Sep. 1981
Michael K. Sain 1981 140 p refs
(Grant NsG-3048)
(NASA-CR-168894; NAS 1.26:168894; TPR-12) Avail: NTIS HC A07/MF A01 CSCL 21E

Research centered on basic topics in the modeling and feedback control of nonlinear dynamical systems is reported. Of special interest were the following topics: (1) the role of series descriptions, especially insofar as they relate to questions of scheduling, in the control of gas turbine engines; (2) the use of algebraic tensor theory as a technique for parameterizing such descriptions; (3) the relationship between tensor methodology and other parts of the nonlinear literature; (4) the improvement of interactive methods for parameter selection within a tensor viewpoint; and (5) study of feedback gain representation as a counterpart to these modeling and parameterization ideas. Author

N82-23248*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
ANALYSIS OF HIGH LOAD DAMPERS Final Report
S. T. Bhat, D. F. Buono, and D. H. Hibner 21 Aug. 1981 79 p refs
(Contract NAS3-22518)
(NASA-CR-165503; NAS 1.26:165503; PWA-5779-10) Avail: NTIS HC A05/MF A01 CSCL 21E

High load damping requirements for modern jet engines are discussed. The design of damping systems which could satisfy these requirements is also discusseed. In order to evaluate high load damping requirements, engines in three major classes were studied; large transport engines, small general aviation engines, and military engines. Four damper concepts applicable to these engines were evaluated; multi-ring, cartridge, curved beam, and viscous/friction. The most promising damper concept was selected for each engine and performance was assessed relative to conventional dampers and in light of projected damping requirements for advanced jet engines. B.W.

N82-23249*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
ADVANCED TURBINE STUDY Final Report, Aug. 1980 - Dec. 1981
12 Apr. 1982 94 p
(Contract NAS8-33821)
(NASA-CR-162003; NAS 1.26:162003; FR-15978) Avail: NTIS HC A05/MF A01 CSCL 21E

Experiments to determine the available increase in turbine horsepower achieved by increasing turbine inlet temperature over a range of 1800 to 2600 R, while applying current gas turbine airfoil cling technology are discussed. Four cases of rocket turbine operating conditions were investigated. Two of the cases used O2/H2 propellant, one with a fuel flowrate of 160 pps, the other 80 pps. Two cases used O2/CH4 propellant, each having different fuel flowrates, pressure ratios, and inlet pressures. Film cooling was found to be the required scheme for these rocket turbine applications because of the high heat flux environments. Conventional convective or impingement cooling, used in jet engines, is inadequate in a rocket turbine environment because of the resulting high temperature gradients in the airfoil wall, causing high strains and low cyclic life. The hydrogen-rich turbine environment experienced a loss, or no gain, in delivered horsepower as turbine inlet temperature was increased at constant airfoil life. The effects of film cooling with regard to reduced flow available for turbine work, dilution of mainstream gas temperature and cooling reentry losses, offset the relatively low specific work capability of hydrogen when increasing turbine inlet temperature over the 1800 to 2600 R range. However, the methane-rich environment experienced an increase in delivered horsepower as turbine inlet temperature was increased at constant airfoil life. The results of a materials survey and heat transfer and durability analysis are discussed. M.G.

N82-23250# Shaker Research Corp., Ballston Lake, N. Y.
BASIC TECHNOLOGY OF SQUEEZE-FILM DAMPERS FOR ROTOR DYNAMICS CONTROL Final Report, Jul. 1978 - Jul. 1981
C. H. T. Pan Nov. 1981 47 p refs
(Contract DAAG29-78-C-0027)
(AD-A110842; SRC-81-TR-74; ARO-15657.4-E) Avail: NTIS HC A03/MF A01 CSCL 21/5

Research was performed to develop a rigorous treatment for the film rupture process in the squeeze-film damper. The short bearing analysis was generalized to accommodate a consistent treatment of the rupture domain for a squeeze-film damper, which is undergoing a circular orbit motion either in a submerged condition or with one end subjected to a pressurized feed condition. GRA

N82-23251# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
SUPERSONIC COMBUSTOR INSULATION ABLATION ANALYSIS AND TESTS
Robb W. Newman and Harold G. Fox 14 May 1981 27 p refs
(AD-A111789) Avail: NTIS HC 03/MF A01 CSCL 21/5

The design of passively cooled, hypersonic tactical missiles poses many severe structural problems whose solutions are beyond the current state-of-the-art. Specifically, the heating conditions in the supersonic combustor of such a missile approach those in the throat section of rocket motors but are more damaging to most materials because the flow is oxidizing rather than reducing. Carbon-carbon materials are being considered for the supersonic combustor wall structure because they have attractive strength-weight characteristics at elevated temperatures. Since these materials which form an oxidation resistant layer are also being considered. In order to design such a combustor, the designer must be able to accurately predict the erosion rate of candidate materials so that a realistic balance can be achieved between

weight and performance. This paper addresses the problem of thermochemical erosion of graphitic materials, the development of procedures for the analytical prediction of these erosion rates in a combustor environment, and experimental procedures used to validate the analytical model and evaluate candidate combustor liner materials. Author (GRA)

N82-23169# Aeronautical Research Associates of Princeton, Inc., N. J.
THRUST AUGMENTING EJECTORS: A REVIEW OF THE APPLICATION OF JET MECHANICS TO V/STOL AIRCRAFT PROPULSION
Brian Quinn *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23170# Centre d'Etudes et de Recherches, Toulouse (France). Dept. of Aerothermodynamique.
THEORETICAL OPTIMISATION AND EXPERIMENTAL VERIFICATION OF AN INJECTOR
A. Mignosi *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs In FRENCH; ENGLISH summary (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23172# Universite Scientifique et Medicale de Grenoble (France). Inst. de Mechanique.
IMPROVEMENT OF EJECTOR THRUST AUGMENTATION BY PULSATING OR FLAPPING JETS
G. Binder and H. Didelle *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 11 p refs Sponsored in part by Minstere de la Defense (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23174# Alfa Romeo S.p.A., Naples (Italy).
TURBOPROP AND TURBOJET EJECTOR OPTIMISATION
V. P. Riviello, A. Murolo, and G. Torella (Italian Air Force Academy) *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 13 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N82-23252# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Kurzuebersicht fuer Information und Dokumentation.
ACTTA: INVESTIGATION OF NEW PILOTING AND FLIGHT CONTROL TECHNOLOGIES. VOLUME 1: REVIEW; ACTIVE WING Milestone Report on Phase 1, 1979 - 1980 [ACTTA: UNTERSUCHUNG NEUARTIGER STEUERUNGS- UND FLUGFUEHRUNGSTECHNOLOGIEN. MEILENSTEINBERICHT ZUR PHASE 1: 1979/1980. BAND 1: UEBERSICHT; AKTIVER FLUEGEL]
Weise Kolander and U. A. Fischer 23 Mar. 1981 192 p refs In GERMAN 2 Vol.
(Contract BMFT-LFK-7960-9)
(MBB-UH-05-81-Vol-1) Avail: NTIS HC A09/MF A01

Flight control technologies were investigated as to their realizability and economy. The conceptual phase of project Active Wing is presented. Investigation methodology, calculation methods, tests, and results, concerning system interpretation, system dynamics and achievable cost reduction, are described. The problems with an integrated digital flight control system are treated. Gust load alleviation can be realized with available components. Operating cost reductions from 1% to 1.5% can be obtained. The choice of control surfaces represents a risk, since their unsteady highly subsonic aerodynamics during fast control is not sufficiently known. Author (ESA)

N82-23253# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Kurzueberischt fuer Information und Dokumentation.
ACTTA: INVESTIGATION OF NEW PILOTING AND FLIGHT CONTROL TECHNOLOGIES. VOLUME 2: AIRCRAFT WITH REDUCED LATERAL STABILITY Milestone Report on Phase 1, 1979 - 1980 [ACTTA: UNTERSUCHUNG NEUARTIGER STEUERUNGS- UND FLUGFUEHRUNGSTECHNOLOGIEN. MEILENSTEINBERICHT ZUR PHASE 1: 1979/1980. BAND 2: FLUGZEUG REDUZIERTER LAENGSSTABILITAET]
Weise Kolander and U. A. Fischer 23 Mar. 1981 194 p refs In GERMAN 2 Vol.
(Contract BMFT-LFK-7960-9)
(MBB-UH-05-81-Vol-2) Avail: NTIS HC A09/MF A01

The stretched version of the A-300 aircraft was used to assess the feasibility and economy of various digital flight technologies for aircraft with reduced lateral stability. Investigation methodology, calculation methods, tests, and results, concerning system interpretation, system dynamics and achievable cost reduction, are described. Operating cost reduction of 1% to 3% is expected with reduced stability, using a trim tank as the first step in a stepped design where sufficient emergency flight safety is maintained in case the stabilizing system fails. Author (ESA)

N82-23185# McDonnell Aircraft Co., St. Louis, Mo.
INTEGRATED FLIGHT AND FIRE CONTROL DEMONSTRATION ON AN F-15B AIRCRAFT: SYSTEM DEVELOPMENT AND GROUND TEST RESULTS
R. J. Landy, C. A. Scolatti, and J. E. Hunter (AFWAL) *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 17 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

N82-23189# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF COMPUTING SYSTEM CONFIGURATIONS FOR HIGHLY INTEGRATED GUIDANCE AND CONTROL SYSTEMS
J. Edwin Jones, Jay S. Karmarkar, and Randall E. Fleming *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 9 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N82-23254* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
METRIC HALF-SPAN MODEL SUPPORT SYSTEM Patent
Charlie M. Jackson, Jr., Samuel M. Dollyhigh, and David S. Shaw, inventors (to NASA) Issued 4 May 1982 5 p Filed Supersedes N80-24334 (18 - 15, p 1943)
(NASA-Case-LAR-12441-1; US-Patent-4,327,581;
US-Patent-Appl-SN-145210; US-Patent-Class-73-147) Avail: US Patent and Trademark Office CSCL 14B

A model support system used to support a model in a wind tunnel test section is described. The model comprises a metric, or measured, half-span supported by a nonmetric, or nonmeasured half-span which is connected to a sting support. Moments and forces acting on the metric half-span are measured without interference from the support system during a wind tunnel test.
Official Gazette of the U.S. Patent and Trademark Office

N82-23255# British Aerospace Aircraft Group, Preston (England). Engine Simulation Section.
DEVELOPMENT OF A CONVOLUTED INTAKE SEAL FOR MODEL R66
A. P. Winstanley Mar. 1981 33 p refs

(BAE-ARG-163) Copyright. Avail: NTIS HC A03/MF A01

A low constraint convoluted seal is described which connects the live intake to the earthed ejector duct in a 1/7.5 scale low speed model with full engine simulation. A 6 component model with two earthed ejectors is required. Several seals were tested, achieving a progressively lower constraint by modifying either the geometry, material or manufacturing process. Subjecting the final seal to a representative pressure difference and end offset causes a lateral load of 6N, but incorporating the modifications recommended for future seals reduces this. Because the seals are on a moment arm from the balance when they are installed in the model, calibrations may have to account for pressure and end misalignment. A facility for measuring pressure differences at the seal is incorporated in the design. Author (ESA)

N82-23363*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Structures and Mechanisms Sect.

ELASTIC SUSPENSION OF A WIND TUNNEL TEST SECTION

Russell Hacker, Stephen Rock (Systems Control Inc., Palo Alto, Calif.), and Daniel B. DeBra (Sanford Univ.) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 277-297 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N82-23365*# Lockheed Missiles and Space Co., Sunnyvale, Calif. RF/Antenna Systems Lab.

DESIGN, DEVELOPMENT AND MECHANIZATION OF A PRECISION DEPLOYABLE TRUSS WITH OPTIMIZED STRUCTURAL EFFICIENCY FOR SPACEBORNE APPLICATIONS

N. D. Craighead, Timothy D. Hult, and Richard J. Preliasco *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 315-328 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N82-23256# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

A METHOD OF PRODUCING ANALYTICAL ORBIT MODELS FOR GEOSTATIONARY SATELLITES

Martin Eckstein Aug. 1979 31 p refs In GERMAN; ENGLISH summary Translation was announced as N81-21111
(DFVLR-FB-79-16) Avail: NTIS HC A03/MF A01

The general analytical expressions of satellite orbit perturbations are lengthly and complicated. However, considerable simplifications can be achieved for nearly geostationary satellites. Whereas the analytical form of the perturbations is derived by geometrical considerations, the coefficients are determined by multiple Fourier analysis. The result is a single formula representing the entire perturbation theory of nearly geostationary satellites terms of 'geostationary elements' so as to avoid singularities for zero eccentricity and inclination. The computer program generates subroutines ready to be called in orbit prediction programs. Author

N82-23257# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

AERODYNAMICS OF A ROLLING AIRFRAME MISSILE

L. E. Tisserand 14 May 1981 23 p refs
(Contract N00017-72-C-4401)
(AD-A111769) Avail: NTIS HC A02/MF A01 CSCL 20/4

For guidance-related reasons, there is considerable interest in rolling missiles having single-plane steering capability. To aid the aerodynamic design of these airframes, a unique investigation into the aerodynamics of a rolling, steering missile has been carried out. It represents the first known attempt to measure in a wind tunnel the aerodynamic forces and moments that act on a spinning body-canard-tail configuration that exercises canard steering in phase with body roll position. Measurements were made with the model spinning at steady-state roll rates ranging from 15 to 40 Hz over an angle-of-attack range up to about 16 deg. This short, exploratory investigation has demonstrated that a better understanding and a more complete definition of the aerodynamics of rolling, steering vehicles can be developed by way of simulative wind-tunnel testing. GRA

N82-23188# Raytheon Co., Bedford, Mass. Missile Systems Div.

HARDWARE-SOFTWARE TRADE-OFFS FOR DIGITAL FLIGHT CONTROL OF GUIDED MISSILES

F. William Nesline and Paul Zarchan *In* AGARD Guidance and Control Technol. for Highly Integrated Systems Feb. 1982 25 p refs (For primary document see N82-23182 14-01)
Avail: NTIS HC A09/MF A01

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N82-23258*# National Aeronautics and Space Administration, Washington, D. C.

OSTA-1 POST MISSION OPERATION REPORT

1982 17 p
(NASA-TM-84191; NAS 1.15:84191; S-420-81-01) Avail: NTIS HC A02/MF A01 CSCL 22A

The first science and applications payload for the space shuttle was carried on STS-2. The space shuttle's performance and systems were tested. The Shuttle's capability of providing a platform for scientific and applications research was demonstrated. The OSTA-1 payload was selected and developed to demonstrate

this secondary objective. The experiments selected for the OSTA-1 payload were concerned with remote sensing of Earth resources, environmental quality, ocean conditions, meteorological phenomena and life sciences. These experiments demonstrated the Shuttle's capability for space research and the potential application of techniques for future remote sensing. S.L.

N82-23259*# National Aeronautics and Space Administration, Washington, D. C.
STS-3 MISSION ASSESSMENT Mission Operation Report
1982 16 p
(NASA-TM-84192; NAS 1.15:84192; M-989-82-03) Avail: NTIS HC A02/MF A01 CSCL 22A

The achievement of the STS-3 mission objectives is assessed, and a detailed description of the flight is provided. Countdown and ground operations are discussed. Flight summaries concerning the remote manipulator system, long duration thermal attitude tests, OSS-1 science objectives, and orbiter experiments are included. S.L.

N82-23345*# Rockwell International Corp., Downey, Calif. Space Transportation and Systems Group.
BAGGIE: A UNIQUE SOLUTION TO AN ORBITER ICING PROBLEM
Louis J. Walkover *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 1-22 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N82-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT SUPPORT SYSTEM MECHANISMS
In NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 23-44 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N82-23347*# Spar Aerospace Products Ltd., Toronto (Ontario).
THE DESIGN AND DEVELOPMENT OF AN END EFFECTOR FOR THE SHUTTLE REMOTE MANIPULATOR SYSTEM
Robert G. Daniell and Savi S. Sachdev *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 45-62 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N82-23348*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CENTERLINE LATCH TOOL FOR CONTINGENCY ORBITER DOOR CLOSURE
Robert C. Trevino *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 63-85 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N82-23364*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE EXTERNAL TANK GASEOUS OXYGEN VENT SYSTEM
William G. Franklin *In its* The 16th Aerospace Mech. Symp. May 1982 p 299-313 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N82-23260*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A USER'S GUIDE TO THE GEOMLLS COMPUTER PROGRAM FOR DETERMINING THE GEOMETRY OF LARGE SEGMENTED SURFACES
Adnan H. Nayfeh, Melvin S. Anderson, and Catherine L. Herstrom Mar. 1981 18 p refs
(NASA-TM-81944; NAS 1.15:81944) Avail: NTIS CSCL 22B

The GEOMLLS computer program determines dimensions and coordinates of flat segmented triangular surfaces which approximate spherical and paraboloidal surfaces of revolution where the vertices of the triangles lie on the true surface. This program is capable of calculating the complete geometry of the segmented surface and quantities that measure surface accuracy such as maximum deviation and root mean square (rms) deviation from true surface. A 'self-contained' subroutine is included which enables the required design to be displayed graphically. A.R.H.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N82-23261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENVIRONMENTALLY INDUCED DISCHARGES ON SATELLITES
N. John Stevens 1982 14 p refs Presented at the 2nd EMC Seminar, Noordwijk, Netherlands, 11-13 May 1982; sponsored by ESTEC
(NASA-TM-82849; E-1219; NAS 1.15:82849) Avail: NTIS HC A02/MF A01 CSCL 22B

The problem of assessing hazards to geosynchronous satellite systems from geomagnetic substorm encounters is investigated. The available space flight data, coupled with analytical modeling studies, show that only relatively low differential charging is possible from environmental encounters. Using an analytical study of a discharge event on SCATHA, a discharge process is postulated where a small amount of charge is lost to space. These characteristics could then be used as inputs to a coupling model to determine the hazard to a spacecraft. The procedure is applied to a three axis stabilized satellite design. B.W.

N82-23262*# Rockwell International Corp., Downey, Calif.
AN ASSESSMENT OF ALTERNATE THERMAL PROTECTION SYSTEMS FOR THE SPACE SHUTTLE ORBITER, VOLUME 1 Final Executive Summary
D. Hays Washington NASA Apr. 1982 66 p refs
(Contract NAS1-16302)
(NASA-CR-3548; NAS 1.26:3548; STS-81-0549-1) Avail: NTIS HC A04/MF A01 CSCL 22B

Alternate thermal protection system (TPS) concepts to the Space Shuttle Orbiter were assessed. Metallic, ablator, and carbon-carbon concepts which are the result of some previous design, manufacturing and testing effort were considered. Emphasis was placed on improved TPS durability, which could potentially reduce life cycle costs and improve Orbiter operational characteristics. Integrated concept/orbiter point designs were generated and analyzed on the basis of Shuttle design environments and criteria. A merit function evaluation methodology based on mission impact, life cycle costs, and risk was developed to compare the candidate concepts and to identify the best alternate. Voids and deficiencies in the technology were identified, along with recommended activities to overcome them. Finally, programmatic plans, including ROM costs and schedules, were developed for all activities required to bring the selected alternate system up to operational readiness. S.L.

N82-23263# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
MULTILAYER INSULATION BLANKETS FOR SPACECRAFT APPLICATIONS. THERMAL MODEL ACCOUNTING FOR

OUTGASSING AND DIFFERENT WAYS OF GAS MIGRATION
A. A. M. Delil and J. F. Heemskerk 2 Sep. 1981 10 p refs Presented at 7th Intern. Heat Transfer Conf., Munich, 6-10 Sep. 1982
(NLR-MP-81051-U) Avail: NTIS HC A02/MF A01

A model of hybrid pumping (broadside and edge) in spacecraft insulation blankets was developed for an evacuated circular multilayer insulation blanket placed between a hot and a cold boundary. The blanket consists of parallel identical perforated shields with left and right side emissivity. Shield thickness is so small that shield temperature is assumed to be even. The gas is assumed to flow from the hot towards the cold boundary, as in the case of insulation of a hot black box from cold space environment. The model also applies for cryogenic vessel insulation (the cryogen at the cold side, the low pressure environment at the hot boundary) by interchanging suffixes in the governing equations. Results from guarded hot plate calorimeter tests confirm model predictions. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N82-23264# European Space Agency, Paris (France).
INVESTIGATIONS ON AND DEVELOPMENT OF A HALL ION THRUSTER Ph.D. Thesis - Stuttgart Univ.
Friedrich Lindner Feb. 1982 119 p refs Transl. into ENGLISH from 'Untersuchungen u. Entwicklungen an einem Hall-Ionen-Beschleuniger' Rept. DFVLR-FB-80-09 DFVLR, Stuttgart, Sep. 1979 127 p Original report in GERMAN previously announced as ESA-95312
(ESA-TT-682; DFVLR-FB-80-09) Avail: NTIS HC A06/MF A01; original report in GERMAN available at DFVLR, Cologne DM 20

An ion accelerator with a pot core geometry was developed. By superimposing a weak radial electric field the calculated electron path is influenced such that the electron either travels to the inner wall of the channel or describes a circular path in the channel. The stabilizing radial electric field establishes itself in operation by an appropriate charging of the insulated channel walls. A permanent magnet generates the radial magnetic field and helps keep the dimensions of the accelerator small. As a result of shortening the inner pole shoe, the magnetic field lines at the channel exit are so directed that the beam is concentrated. An emitter of extremely large surface area decreases the total voltage. Mounting the emission cathode independently of the accelerator reduces the thermal loading of the accelerator.
Author (ESA)

N82-23265# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany). Fachgruppe 12.
COMPOUND ROCKETS [ZUSAMMENGESETZTE RAKETEN]
Johannes Winkler 1981 43 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-81-02) Avail: NTIS HC A03/MF A01; DGLR; Cologne DM 18

An economical means to realize large rockets, following the bunching principle and based on a theory by Johannes Winkler, is discussed. It is shown that undivided rockets have a limited action radius of about 500 km. This limit can be extended with multistage rockets whose realizability is not proven. Realized and realizable rockets of intermediate size, consisting of a large number of similar rockets, were studied. A characteristic number is given, leading to approaches to an appropriate rocket construction. Rockets are listed with their characteristic numbers. Author (ESA)

N82-23266# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
LABORATORY STUDIES FOR BEAM PLASMA DISCHARGE EXPERIMENTS WITH ROCKETS
A. Kiraga (Academy of Siences, Poland), L. Yu. Kochmarev (Academy of Sciences, USSR), Z. Kloss (Academy of Sciences, Poland), Z. Kravchic (Academy of Sciences, Poland), A. N. Laliashvili (Academy of Sciences of the Georgian SSR, USSR), N. A. Leonov (Kiev State Univ.), S. B. Lyakhov (Academy of Sciences, USSR), A. D. Mairov (Academy of Sciences, USSR), G. G. Managadze (Academy of Sciences, USSR), O. A. Povalyaev (Academy of Sciences, USSR) et al May 1981 37 p refs
(INW-8106) Avail: NTIS HC A03/MF A01

Laboratory results of beam plasma discharge (BPD) of several meters in a homogeneous atmosphere and a jet of inert gas are presented. The beam was obtained by an electron gun of the type used in rocket experiments. The BPD glow intensity, electromagnetic field and its spectral distribution, the concentration and temperature of electrons in the plasma, and the flux of scattered electrons were measured. The BPD was photographed. The threshold of BPD ignition was determined as a function of gas pressure and beam parameters. Spontaneous BPD oscillations appear in the gas jet at 25 kHz. Spontaneous BPD quenching and igniting with periods up to 50 msec occurs. The RF modulation of the beam can significantly decrease the BPD ignition threshold of the neutral gas pressure and change plasma formation characteristics. A higher sampling rate for rocket telemetry is recommended. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N82-23267# Washington Univ., Seattle.
THE INITIAL STAGE OF SINTERING MAGNESIUM-OXIDE Ph.D. Thesis
Jose Arana Varela 1981 130 p
Avail: Univ. Microfilms Order No. 8126154

Ultrafine MgO powder compacts were sintered in argon with controlled water vapor partial pressure ranging from zero (dry argon) to 760 torr and at temperatures ranging from 900 to 1395 C. The progress of sintering was observed by measuring pore size distribution, bulk density, and surface area using mercury porosimetry, surface area using nitrogen adsorption, and crystal size using X-ray line broadening. The effective activation energies were found to depend on the degree of densification due mainly to the effect of rearrangement in the early stage. The rate of sintering was proportional to the water vapor pressure raised to a power between 1.0 and 1.5. The rate of crystal growth was observed to be very low in dry argon and increased with increasing water vapor partial pressures and temperatures. The crystal size measured by the integral-breadth method showed a dependence

with time. The same dependence of rate constants with pressure was observed for densification indicating that the same mechanism(s) are controlling densification and crystal growth. At low temperatures pore closure occurs in the first minutes of sintering and then, with time, pore growth, whereas at higher temperatures pore size always decreases with temperature and time.
Dissert. Abstr.

N82-23268*# Douglas Aircraft Co., Inc., Long Beach, Calif.
WOVEN GRAPHITE EPOXY COMPOSITE TEST SPECIMENS WITH GLASS BUFFER STRIPS Final Report
G. R. Bonnar and R. J. Palmer May 1982 76 p refs
(Contract NAS1-16677)
(NASA-CR-165871; NAS 1.26:165871) Avail: NTIS HC A05/MF A01 CSCL 11D

Woven unidirectional graphite cloth with bands of fiberglass replacing the graphite in discrete lengthwise locations was impregnated with epoxy resin and used to fabricate a series of composite tensile and shear specimens. The finished panels, with the fiberglass buffer strips, were tested. Details of the fabrication process are reported. M.D.K.

N82-23269*# Polytechnic Inst. of Brooklyn, New York, N.Y.
EXPERIMENTAL INVESTIGATION OF GRAPHITE/POLYIMIDE SANDWICH PANELS IN EDGEWISE COMPRESSION M.S. Thesis
Charles Joseph Camarda Jun. 1974 147 p refs
(NASA-TM-84182; NAS 1.15:84182) Avail: NTIS HC A07/MF A01 CSCL 20K

The local and general buckling of graphite/polyimide sandwich panels simply supported along all four edges and loaded in uniaxial edgewise compression is investigated. Material properties of sandwich panel constituents (adhesive and facings) were determined from flatwise tension and sandwich beam flexure tests. An adhesive bond study resulted in the selection of a suitable cure cycle for FM 34 polyimide film adhesive and, a bonding technique using a liquid cell edge version of that adhesive resulted in considerable mass savings. Tensile and compressive material properties of the facings, quasiisotropic, symmetric, laminates (0, +45,90,-45)s of Celion/PMR-15, were determined at 116, R.T., and 589 K (-250, R.T., and 600 F) usng the sandwich beam flexure test method. Results indicate the Gr/PI is a usable structural material for short term use at temperatures as high as 589 K (600 F). Buckling specimens were 1006.5 sq cm. 156 sq in., had quasiisotropic symmetric facings (0, + or -45,90)s and a glass/polyimide honeycomb core (HRH-327-3/8-4). S.L.

N82-23270# Hughes Aircraft Co., Culver City, Calif. Technology Support Div.
DEVELOPMENT OF NON-GLASS GLAZINGS AND SURFACE COATINGS
Norman Bilow, Richard I. Akawie, Danute I. Basiulis, and Abraham L. Landis Jul. 1981 54 p refs
(Contracts DE-AC04-78CS-35301; EM-78-C-04-5301)
(DE81-028000; DOE/CS-35301/T2) Avail: NTIS HC A04/MF A01

Eight types of polycarbonates were synthesized in an effort to develop at least one which had significantly improved solar radiation stability relative to bisphenol A polycarbonate without a serious loss of other desirable properties. Of these materials, one was derived from cycloaliphatic diol, two were derived from bicycloaliphatic diphenols, one was derived from a perfluoroalkylene-substituted diphenol, and three were derived from diphenols which had all of their positions ortho to the phenolic hydroxyl groups substituted by either methyl groups or chlorine atoms. Each polymer was synthesized several times to provide products with various mean molecular weights. This was necessary to compare their relative ease of fabrication. Thermal properties of the new polymers were studied by thermal differential analysis, thermomechanical analysis, and thermogravimetric analysis, and relative solar radiation stability was studied by exposing samples to simulated solar radiation in the an Atlas Weatherometer, which also provided 9 minutes of rain per hour. DOE

N82-23271# Research Inst. of National Defence, Linkoeping (Sweden).
IMPRESSIONS FROM THE FOURTH INTERNATIONAL RADOMES CONFERENCE [INTRYCK FRAAN DEN FJAERDE INTERNATIONELLA RADOMKONFERENSEN PAA ILE DE BENDOR 10-12 JUN. 1981]
Aake Bergquist Dec. 1981 21 p refs In SWEDISH Conf. held at Ile de Bendor, 10-12 Jun. 1981
(FOA-C-30245-E) Avail: NTIS HC A02/MF A01

Radar antenna dome covers and radome materials are discussed. Rain impact damage, thermal resistance and infrared windows are treated. Sandwich structures, plastics, reinforced materials, polyurethane foam, and zone sulfide material are considered. Fiber reinforced fluorocarbons, permittivity, loss factor, radome design and performance tests are dealt with.
Author (ESA)

N82-23272# Oxford Univ. (England). Dept. of Engineering Science.
THE FAILURE OF GLASS-REINFORCED COMPOSITES UNDER DYNAMIC TORSIONAL LOADING
T. Parry and J. Harding 1981 19 p refs Presented at CNRS Intern. Colloq. on Plastic Behavior of Anisotropic Solids, Villard-de-Lans, France, 15-19 Jun. 1981
(OUEL-1365/81) Avail: NTIS HC A02/MF A01

Techniques for impact testing composite materials are discussed. The application of the torsional Hopkinson pressure bar on the study of the dynamic failure of glass reinforced epoxy based composites is described. Torque-twist curves are presented for thin walled tubular specimens of crossply and woven mat reinforced laminates, cut with the specimen axis perpendicular to the interlaminar plane, at nominal average shear strain rates in the range 100 to 600/sec. The fracture surfaces are examined. The proposed failure process is characterized by two stages: the initiation of failure by the formation of cracks on planes inclined at 45 deg to the specimen axis at a stress level strongly dependent on strain rate; and the propagation of failure predominantly on interlaminar planes at a higher stress, less strongly dependent on strain rate. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N82-23273# Columbia Univ., New York.
PARTICLE COARSENING IN A MICROPOROUS SUPPORTED PLATINUM CATALYST Ph.D. Thesis
Lewis D. Roth 1981 135 p
Avail: Univ. Microfilms Order No. 8125377

The growth and coarsening phenomena of platinum catalyst particles supported on a microporous substrate were studied. The coarsening of the particles was measured by direct observation with Transmission Electron Microscopy (TEM) in addition to the more conventional CO chemisorption techniques on the same samples. Comparison of data from the two techniques show an increasingly large navigation between the two methods of measurement as the particles coarsen to the mean pore size of the substrate. Dissert. Abstr.

N82-23274# California Univ., Berkeley.
AN EXPERIMENTAL STUDY OF COMBUSTION: THE TURBULENT STRUCTURE OF A REACTING SHEAR LAYER FORMED AT A REARWARD-FACING STEP Ph.D. Thesis
Robert Wendell Pitz 1981 165 p
Avail: Univ. Microfilms Order No. 8200238

A premixed propane air flame was stabilized in a turbulent free shear layer formed at a rearward-facing step. The mean and rms averages of the turbulent velocity flow field were determined by laser doppler velocimeters (LDV) for both reacting and nonreacting flows. Large scale structures dominate the reacting shear layer. The growth of the large scale structures is tied to the propagation of the flame. The linear growth rate of

the reacting shear layer defined by the mean velocity profiles is unchanged by combustion but the virtual origin is shifted downstream. The reacting shear layer based on the mean velocity profiles is shifted toward the recirculation zone and the reattachment lengths are shortened by 30%. The edge of the flame controlled by the large scale structure development propagates faster into the incoming reactants than the boundary of the shear layer given by the mean velocity flow field. This results in non-Gaussian behavior above the shear layer. Under combustion, measurements of the passing frequency of the large scale structures from LDV spectra indicate that the coalescence rate is sharply reduced. The pairing process in the reacting shear layer is nearly eliminated as a growth mechanism.Dissert. Abstr.

N82-23275# Case Western Reserve Univ., Cleveland, Ohio.
LEED-AES-THIN LAYER ELECTROCHEMICAL STUDIES OF HYDROGEN ADSORPTION ANODIC FILM GROWTH ON Pt SINGLE CRYSTALS Ph.D. Thesis
Arthur S. Homa 1981 104 p
Avail: Univ. Microfilms Order No. 8200349

The understanding of the relation of electrochemical catalysis to electrode surface structure requires measurements on single crystal electrode surfaces which are free of impurities and understanding of well defined morphology. A system was developed which allows preparation and characterization of such surfaces in a UHV system, their electrochemical examination and the subsequent reexamination of surface morphology and purity. Specialized transfer and thin layer cell techniques minimize problems associated with transfer between the UHV and electrochemical environment. The electrochemical adsorption of hydrogen from dilute HF on the three low index planes of Pt was studied. By restricting the potential range to 0.05-0.5V vs. RHE(1atm), postelectrochemical LEED analysis shows that the initial surfaces maintain a large degree of long range order. Contamination levels typically better than 0.1 monolayers of carbon as measured by AES are observed after retransfer.
Dissert. Abstr.

N82-23276# California Univ., Berkeley.
LASER INDUCED CHEMICAL REACTIONS Ph.D. Thesis
Ann Elizabeth Orel 1981 113 p
Avail: Univ. Microfilms Order No. 8200230

An extension of a classical model to treat laser induced electronically nonadiabatic collision processes were constructed. The model treats all degrees of freedom, molecular, electronic and radiation, in a dynamically consistent framework within classical mechanics. Application was made to several systems. Several interesting phenomena were discovered including a Franck-Condon like effect causing maxima in the reaction probability at energies much below the classical threshold laser de-enhancement of chemical reactions, and an isotope effect. In order to assess the validity of the classical model for electronically nonadiabatic process (without a laser field), a model problem involving energy transfer in a collinear atom-diatom system was studied and the results compared to the available quantum mechanical calculation. It was found that the calculations are in qualitative agreement. Dissert. Abstr.

N82-23277# New Hampshire Univ., Durham.
FLAME PHOTOMETRY OF PHOSPHORUS AND SULFUR BY GRAPHITE ATOMIZER VAPORIZATION Ph.D. Thesis
Arthur Rudolf Driedger, III 1981 135 p
Avail: Univ. Microfilms Order No. 8129263

Flame photometry as a method for phosphorus analysis was investigated. Aqueous phosphate samples are introduced using a Perkin-Elmer HGA 2100 graphite atomizer coupled to a flame photometer. The atomizer dries the sample at 100 C then vaporizes the phosphorus compound at 2500 C. The phosphorus vapor is swept into the flame and the HPO emission is measured. Intensity is directly proportional to phosphorus concentration. This method of sample introduction has fewer metal ion interferences than the aerosol technique, however, common ions such as calcium, magnesium, and ion III, still interfere. It was found that the metal ion interference takes place in the vapor phase after atomization. It was found that silica reduced the degree of interference. The graphite tube under was impregnated with SiCl4 reduced pressure, the SiCl4 hydrolyzed to hydrated silica, and the tube dried and fired at a high temperature. The appearance temperature for phosphorus as phosphate in the presence of calcium is 1400 C for untreated graphite and 2000 C for the silicon carbide coated tube. At a higher temperature, the metal-phosphorus interaction causing the interference is less favorable,thus causing a reduction in the extent of the interference. Eleven possible interfering ions were tested to determine the degree of interference. By making a few minor modifications to the instrument, sulfur can be determined. Dissert. Abstr.

N82-23278# Iowa State Univ. of Science and Technology, Ames.
A MASS SPECTROMETRIC DETERMINATION OF TRACE ELEMENTS IN AQUEOUS MEDIA WITHOUT PRECONCENTRATION Ph.D. Thesis
Gordon Oluf Foss 1981 106 p
Avail: Univ. Microfilms Order No. 8128816

The feasibility of using a low pressure glow discharge as an ion source for the mass spectrometric determination of trace elements in aqueous media was investigated. A cryogenically cooled hollow cathode ion source was developed to analyze aqueous samples without external preconcentration. Aqueous solutions containing seventy elements were analyzed and the detection limits, sensitivity factors, and linear regression correlation coefficients were determined. Tap water and natural lake water samples were examined and minimal interference effects due to organic compounds and biological compounds were noted. A research ion optical system (RIOS) developed as a flexible mass analyzer for the development of new ion sources is described.
Dissert. Abstr.

N82-23279# Iowa Univ., Oakdale.
PYROLYSIS GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC AND MASS SPECTROMETRIC STUDIES OF SELECTED N-CARBOBENZOXY METHYL ESTERS OF AMINO ACIDS AND DIPEPTIDES Ph.D. Thesis
Kai-Cheong Lam 1981 207 p
Avail: Univ. Microfilms Order No. 8128425

In order to investigate the use of pyrolysis gas chromatography-mass spectrometry (GCMS) to characterize amino acid and dipeptide derivatives, the N-carbobenzoxy methyl esters of eleven amino acids and six dipeptides were synthesized and examined. GCMS studies of the amino acid derivatives were used as a reference point for the subsequent pyrolysis studies. Pyrolysis GCMS studies of these same amino acid derivatives indicate the presence of N-terminal sequence-specific fragments as well as fragments characteristic of the particular amino acids. These fragments have relatively high intensities. In the GCMS studies, similar fragments were also observed, but with much lower intensities. The solid probe mass spectrometric studies of the dipeptide derivatives indicate the presence of fragments characteristic of the N-terminal amino acid, and of the C-terminal glycine methyl ester moiety, as well as fragments specific for the individual dipeptides. Pyrograms of the carbobenzoxy dipeptide methyl esters contain multiple peaks with unique retention times. The pyrograms may be used to help identify these compounds. The mass spectra of the pyrolytic products give sequence information only in some cases. Dissert. Abstr.

N82-23280# Wisconsin Univ. - Madison.
ANGULAR DISTRIBUTION MEASUREMENT OF PHOTOELECTRONS PRODUCED FROM GAS PHASE MOLECULES USING POLARIZED SYNCHROTRON RADIATION Ph.D. Thesis
David William Mehaffy 1981 256 p
Avail: Univ. Microfilms Order No. 8124622

An angle resolved differential retarding grid analyzer was designed, constructed, and evaluated with wavelength dispersed synchrotron radiation from an electron storage ring. An electrostatic spherical sector analyzer was also evaluated and has five times the sensitivity and gaussian peak shapes. Both spectrometers were used to measure the angular asymmetry parameter, beta, as a function of photon energy. Nitrogen gave beta values for the $v = 0$ and $v = 1$ vibrational levels of the ground state ion of 0.5 and 1.1, respectively, and remained different over a large energy span. This was attributed to the influence of a shape resonance in a higher ion state. Shape resonances were also investigated in CO2, CS2 and COS. For CO2 a shape resonance was found in the fourth band at 39 eV photon energy. The

resonance was about 4 eV wide and was considerably broader than theory predicted until vibrational motion was included in the calculations. Dissert. Abstr.

N82-23281# Utah Univ., Salt Lake City.
THE EFFECT OF AN ACIDIC CATALYST ON SIMULTANEOUS HYDRODENITROGENATION AND HYDRODESULFURIZATION OF MODEL COMPOUNDS Ph.D. Thesis
Holly Jean Moore 1981 171 p
Avail: Univ. Microfilms Order No. 8125903

The hydrodesulfurization of thiophene and the hydrodenitrogenation of pyridine over acidic catalysts was studied. Four catalysts were considered: CoMo-SiO2/Al2O3, CoMo-Al2O3, NiW-SiO2/Al2O3, and NiW-Al2O3. These catalysts were chosen so that the effect of the metallic complex and the effect of the acidic support could be isolated. Reaction conditions of 200 to 400 C and 40 to 200 psia were used. A two site reaction mechanism (sites 1 and 2) based on the Langmuir adsorption isotherm was used to model the reaction of thiophene. A single site (site 1) analysis described the reaction of pyridine. Values of the reaction rate constants (k), and the adsorption equilibrium constants (K) were calculated from the data collected for pure thiophene, pure pyridine, and for a 50/50 solution of each. The results showed that both thiophene and pyridine adsorb significantly on the type 1 sites, but not on the type 2 sites. No consistent metal effect (NiW or CoMo) was observed. However, alumina was the more effective catalyst substrate for the reaction of both thiophene and pyridine for 50/50 feeds. Alumina was also more effective for pure thiophene reaction, but silica alumina was more effective for pyridine reaction from a pure feed.
Dissert. Abstr.

N82-23282* National Aeronautics and Space Administration. Pasadena Office, Calif.
CRUDE OIL DESULFURIZATION Patent
John J. Kalvinskas (California Inst. of Technology, Pasadena), George C. Hsu (California Inst. of Technology, Pasadena), and John B. Ernest, inventors (to NASA) (California Inst. of Technology, Pasadena) Issued 12 Jan. 1982 4 p Filed 17 Apr. 1979 Sponsored by NASA
(NASA-Case-NPO-14542-1; US-Patent-4,310,049; US-Patent-Appl-SN-030831; US-Patent-Class-166-267; US-Patent-Class-166-303; US-Patent-Class-208-241) Avail: US Patent and Trademark Office CSCL 07D

High sulfur crude oil is desulfurized by a low temperature (25-80 C.) chlorinolysis at ambient pressure in the absence of organic solvent or diluent but in the presence of water (water/oil = 0.3) followed by a water and caustic wash to remove sulfur and chlorine containing reaction products. The process described can be practiced at a well site for the recovery of desulfurized oil used to generate steam for injection into the well for enhanced oil recovery. Author

N82-23283*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
SUPERSONIC BURNING IN SEPARATED FLOW REGIONS Final Report
Glen W. Zumwalt Apr. 1982 53 p refs
(Grant NsG-1575)
(NASA-CR-168914; NAS 1.26:168914; AR-82-2) Avail: NTIS HC A04/MF A01 CSCL 21B

The trough vortex phenomena is used for combustion of hydrogen in a supersonic air stream. This was done in small sizes suitable for igniters in supersonic combustion ramjets so long as the boundary layer displacement thickness is less than 25% of the trough step height. A simple electric spark, properly positioned, ignites the hydrogen in the trough corner. The resulting flame is self sustaining and reignitable. Hydrogen can be injected at the base wall or immediately upstream of the trough. The hydrogen is introduced at low velocity to permit it to be drawn into the corner vortex system and thus experience a long residence time in the combustion region. The igniters can be placed on a skewed back step for angles at least up to 30 deg. without affecting the igniter performance significantly. Certain metals (platinum, copper) act catalytically to improve ignition. S.L.

N82-23284# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
NICKEL-LIKE SPECTRA OF ELEMENTS Y 12 TO Ag 20 FROM A VACUUM SPARK
P. Schweitzer, M. Klapsch, J. L. Schwob, M. Finkenthal (Johns Hopkins Univ., Baltimore), A. BarShalom, P. Mandelbaum, and B. S. Fraenkel May 1980 31 p refs
(EUR-CEA-FC-1050) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The spectra of elements Y, Zr, Nb, Mo, Ru, Rh, Pd and Ag in the range 10-100 A were obtained from a high power vacuum spark and a grazing incidence high resolution spectrograph. The transitions 3d(1)0-3d(9)4p, -3d(9)4f, 3d(9)5p, -3d(9)5f were identified. The agreement with ab initio relativistic calculations is very good. The relevance of jj coupling scheme for level labeling is discussed, as well as the importance of relativistic effects, by comparing with other results on high Z atoms (up to Pt). DOE

N82-23285# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
ELECTROCHEMICAL UTILIZATION OF METAL HYDRIDES
H. F. Bittner and C. C. Badcock 15 Apr. 1982 30 p refs
(ATR-82(8459)-1) Avail: NTIS HC A03/MF A01

The electrochemical utilization of metal hydrides is reviewed. Metal hydrides were investigated for hydrogen storage in nickel hydrogen batteries. The use of hydrides lowered the operating pressures in nickel hydrogen cells, which leads to improved energy density. Metal hydrides used as reversible hydrogen electrodes are discussed. Thermodynamic and kinetic investigations of a variety of hydriding materials are reviewed. S.L.

N82-23286# Pittsburg Energy Technology Center, Pa. Combustion Technology Div.
SMALL-SCALE COMBUSTION TESTING OF SYNTHETIC FUELS
G. A. Gibbon, J. M. Ekmann, C. M. White, R. J. Navadauskas, J. I. Joubert, and H. L. Retcofsky Nov. 1981 21 p refs
(DE82-002791; DOE/PETC-TR-82/1) Avail: NTIS HC A02/MF A01

In order to assess the possible environmental impact of substituting synfuels for petroleum in utility and industrial boilers, two experimental programs have been undertaken at the Pittsburgh Energy Technology Center. First, a fully instrumented 20 hp firetube boiler capable of burning liquid fuels ranging in combustion characteristics from No. 2 to No. 6 petroleum has been installed in the Combustion Division. Second, a sampling and analytical methodology for the organic compounds present in the exhaust duct of the 20 hp boiler is being developed by the Analytical Chemistry Division. This report outlines the progress on this project to date: twenty-four successful combustion runs were completed on the 20 hp boiler, using a variety of petroleum based fuels and synfuels and a sampling protocol for organic vapors in hot exhaust gases was developed. Significant differences in the composition of the trace organics in the exhaust gases were observed as a function of the fuel being burned, but total polynuclear aromatic hydrocarbon levels are comparable for all fuels. DOE

N82-23287# Utah Univ., Salt Lake City. Biomaterials Profiling Center.
CHARACTERIZATION OF ROCKY MOUNTAIN COALS AND COAL LIQUID BY COMPUTERIZED ANALYTICAL TECHNIQUES Annual Progress Report
Hank L. C. Meuzelaar, George R. Hill, Jean H. Futrell, Alice M. Harper, Donna J. Iwamoto, David L. Pope, G. Steven Metcalf, and Joe H. Tomlinson 1981 72 p refs
(Contract DE-FG22-80PC-30242)
(DE82-001802; DOE/PC-30242/T1; APR-1) Avail: NTIS HC A04/MF A01

Over 100 Rocky Mountain coal samples were selected and analyzed by pyrolysis mass spectrometry (MS). Computerized pattern recognition permitted the successful reduction and evaluation of the mass data base generated (over 100,000 mass peak intensities) and revealed strong clustering tendencies of pyrolysis patterns. The pyrolysis mass spectra show strong rank effects allowing complete differentiation between HVCB and HVBB coals partial differentiation both between subbituminous and HVCB

samples and between HVBB ahd HVAB samples. Besides rank effects, marked differences are frequently found between samples from different coal regions, fields or even seams. The high degree of similarity observed between the pyrolysis mass spectra of samples from the same coal seam demonstrates that the combined uncertainties in sample collection, preparation and analysis are much smaller than the chemical differences detected by the pyrolysis MS methodology. DOE

N82-23288# Babcock and Wilcox Co., Alliance, Ohio. Research and Development Div.

COMPUTATIONAL TOOLS FOR PULVERIZED-COAL COMBUSTION Quarterly Report, Jul. - Sep. 1981

W. J. Oberjohn, D. K. Cornelius, W. Fiveland, R. J. Schnipke, and J. H. Wang Nov. 1981 90 p refs

(Contract DE-AC22-81PC-40265)

(DE82-003592; DOE/PC-40265/2; QR-2) Avail: NTIS HC A05/MF A01

The development and verification of modeling the major aspects of pulverized coal combustion is described. The combustion model (COMO) consists of a number of relatively independent modules that represent the major processes involved in pulverized coal combustion. Version 1 of COMO primarily to determine a satisfactory means of integrating the numerical models of the combustion processes into an overall combustion model. Detailed life of the project task descriptions were prepared, literature searches were conducted, and process models were selected. code development guidelines were prepared and reviewed with each task leader; the guidelines present the information required to allow process modules to be developed relatively independently, while providing for the subsequent integration of these modules into COMO. The formulation and coding of the Version 1 gas phase turbulence, chemistry, and radiation models was completed. Test cases were run for each model, and good agreement was obtained with other analyses and with data when available. A formal method for documenting COMO was investigated, and preliminary specifications were developed. DOE

N82-23289# Tennessee Univ., Knoxville. Dept. of Chemistry.

SPECTRO-ELECTROCHEMICAL INVESTIGATIONS IN MOLTEN SALT AND AQUEOUS MEDIA Ph.D. Thesis

Vincent Eugene Norvell Jun. 1981 202 p refs

(Contracts DE-AS05-76OR-05053; EY-76-S-05-5053; Grant NSF CHE-77-21370)

(DE81-031966; DOE/TIC-11495) Avail: NTIS HC A10/MF A01

The electroreduction of the manganese oxyanions in alkaline solutions and the electrooxidation of elemental sulfur and electroreduction of Nb(V) in molten AlCl3-NaCl mixtures was investigated in situ by means of spectroelectrochemical techniques and thin-layer coulometry at optically transparent electrodes. The reduction of the manganese oxyanions in alkaline solutions was found to consist of simple reversible one electron transfer when carried out in solutions in which the reduction product is stable. One or more soluble intermediate species, probably containing Mn(IV) and possibly Mn(V), are formed when reduction is carried out in solutions where the product is unstable and undergoes disproportionation. The effect of varying the pH of the solution on the overall reduction process is discussed. Spectral data on the reduction and oxidation products are presented. The oxidation of elemental sulfur in AlCl3-NaCl (63 to 37 mole %) melt was investigated by means of uv-visible absorption and electron spin resonance spectroelectrochemical techniques. DOE

N82-23290# State Univ. of New York, Stony Brook. Dept. of Chemistry.

ELECTROLYTIC REDUCTION OF Fe(3) AS A PART OF CLOSED Fe(2)/Fe(3) CYCLE FOR PRODUCT REFLUX IN NITROX PROCESS

Motonari Adachi and Takanobu Ishida 16 Oct. 1981 46 p refs

(Contract DE-AC02-80ER-10612)

(DE82-002922; DOE/ER-10612/5) Avail: NTIS HC A03/MF A01

The characteristics of an electrolysis apparatus for reducing Fe(III) in sulfuric acid to Fe(II) was obtained. Using a cylindrical fritted glass partition between a perforated platinum cylinder as cathode and a coiled platinum wire as anode, the current, the current efficiency, and the Fe(III) to Fe(II) conversion ratio were measured as a function of applied voltage, iron concentration, and time in batch operations. At high Fe(III) concentrations, the rate of reduction is insensitive to the iron concentration and determined by anodic processes, which depend on the applied voltage. At low Fe(III) concentrations, the rate is insensitive to the applied voltage and determined by cathodic process, which depend on the Fe(III) concentration. Near 100% current efficiencies were obtained. A close cycle refluxer system was fabricated using a packed reflux column and two electrolytic cells which operates with a 70% to 80% current efficiency. DOE

N82-23291# Georgia Univ., Athens. Dept. of Chemistry.

FUNDAMENTAL STUDIES OF SEPARATION PROCESSES Technical Progress Report, 15 Aug. 1980 - 14 Aug. 1981

L. B. Rogers 1981 18 p refs

(Contract DE-AS09-76ER-00854)

(DE82-000975; DOE/ER-00854/34) Avail: NTIS HC A02/MF A01

Fractionations of vanadium containing nonporphyrin species from crude oil were obtained using high performance liquid chromatography. Samples of monodisperse polystyrene having different nominal molecular weights were used to measure the pore volume and to fingerprint the pore size distribution of different preparations of column packing material. Those measurements are designed to provide a better basis for understanding the separation behavior observed for different derivatized-silica packings used in liquid chromatography. Simulations of chromatograms were made so that numbers related to information contents might be obtained and compared with other methods for evaluating the goodness of a complex chromatogram. Recycle runs using n hexane as a model showed that operation of a gas chromatographic system at a flow rate close to that giving the maximum efficiency not only leads to the larger number of plates but also a more nearly constant behavior from cycle to cycle. DOE

N82-23292# Utah Univ., Salt Lake City. Dept. of Chemistry.

LOW-TEMPERATURE SECONDARY ION MASS SPECTROMETRY OF NEAT AND DILUTED ORGANIC SOLIDS Final Report

Josef Michl 10 Sep. 1981 19 p refs

(Contract DE-AC02-79ER-10373)

(DE82-000866; DOE/ER-10373/1) Avail: NTIS HC A02/MF A01

Secondary ion mass spectra of neat solid argon, krypton, and xenon were measured as a function of the nature and energy of the primary ions, He(+) and Xe(-). With primary ions of large momentum, considerable quantities of large cluster ions of the matrix material are produced. DOE

N82-23293# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Actinide Technology Div.

DISSOLUTION OF ION EXCHANGE RESIN BY HYDROGEN PEROXIDE

S. C. Lee Aug. 1981 32 p refs

(Contract DE-AC09-76SR-00001)

(DE82-000966; DP-1594) Avail: NTIS HC A03/MF A01

The resin dissolution process was conducted successfully in full scale equipment at the SRL Semiworks. A solution containing 0.001 M Fe(2), or Fe(3), and 3 vol % H2O2 in 0.1 M HNO3 is sufficient to dissolve up to 40 vol % resin slurry (Dowex 50W-X8). Foaming and pressurization can be eliminated by maintaining the dissolution temperature below 990 C. The recommended dissolution temperature range is 85 to 900 C. Premixing hydrogen peroxide with all reactants will not create a safety hazard, but operating with a continual feed of hydrogen peroxide is recommended to control the dissolution rate. An air sparging rate of 1.0 to 1.5 scfm will provide sufficient mixing. Spent resin from chemical separation contains DTPA (diethylenetriaminepenaacetic acid) residue, and the resin must be washed with 0.1 M NH4 to remove excess DTPA before dissolution. Gamma irradiation of resin up to 4 kW-hr/L did not change the dissolution rate significantly. DOE

N82-23294# New Mexico Univ., Albuquerque.

PHOTOASSISTED ELECTROLYSIS APPLIED TO COAL GASIFICATION Quarterly Report, 1 Jul. - 30 Sep. 1981

Su-Moon Park 1981 44 p refs

(Contract DE-AC21-81MC-16377)
(DE82-000224; DOE/MC-16377/T1) Avail: NTIS HC A03/MF A01

A literature search and study of coal oxidation mechanisms at noble metal electrodes were made. Ground work on photoassisted electrolysis of coal at the semiconductor thin film electrode was begun by preparing and characterizing n-SnO2 electrodes. It was concluded that coal is oxidized catalytically by iron(III), which in turn is reduced to iron(II). The iron(II) generated from this catalytic reaction undergoes the electrochemical oxidation, completing a cycle. The rate for this catalytic reaction is determined to be aproximately (3.0 for- 1.0) times 100, 000 sec(+1) for iron(III) and 12,000 sec(+1) for Ce(IV) at 200 C, respectively. M.D.K.

N82-23295# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
MASS-SPECTROMETRIC SYSTEMS AND TECHNIQUES FOR FISSION PRODUCT ANALYSIS
R. L. Tromp, J. E. Delmore, R. A. Neilsen, and T. C. Chapman Oct. 1981 31 p refs
(Contract DE-AC07-79ID-01675)
(DE82-001761; ENICO-1094) Avail: NTIS HC A03/MF A01

Mass spectrometer systems and methods used in the isotopic analysis of uranium, plutonium and 13 fission product elements are described. Isotope dilution techniques used in conjunction with these analyses are also included. These procedures evolved during an ongoing program for determining fission yields from a variety of fissile nuclides. Details of ion production, mass spectrometer design and operation, and data reduction are included. DOE

N82-23296# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
ESTIMATION OF DIFFUSION COEFFICIENTS FOR ELECTROLYTES IN HOT WATER Final Report
W. T. Lindsay, Jr. Aug. 1981 58 p refs Sponsored in part by Steam Generator Owners Group
(EPRI Proj. S146-1)
(DE81-904188; EPRI-NP-1963) Avail: NTIS HC A04/MF A01

Diffusion coefficients are calculated for electrolytes dissolved in water at temperatures 25 to 3000 C and saturation pressures. Plots and tables are given of estimated diffusion coefficients for: NaCl at concentrations from infinite dilution to 4 molal; limiting diffusion coefficients for divalent metal chlorides; sodium phosphates of several compositions; and for tracer diffusion coefficients for hydrochloric acid in sodium chlorine solutions up to 4 molal. These data are useful for analysis of mass transport processes, such as concentration, corrosion, deposition, dissolution, dilution and neutralization, that can occur in nuclear steam generators and other power station apparatus. DOE

N82-23297# Pacific Northwest Lab., Richland, Wash.
FRACTIONAL DISTILLATION AS A STRATEGY FOR REDUCING THE GENOTOXIC POTENTIAL OF SRC-2 COAL LIQUIDS Status Report
R. A. Pelroy and B. W. Wilson Sep. 1981 82 p refs
(Contract DE-AC06-76RL-01830)
(DE82-002242; PNL-3787) Avail: NTIS HC A05/MF A01

Results of studies on the effects of fractional distillation on the genotoxic potential of Solvent Refined Coal (SRC-II) liquids are reported. SRC-II source materials and distilled liquids were provided by Pittsburg and Midway Coal Mining Co. Fractional distillations were conducted on products from the P-99 process development unit operating under conditions approximating those anticipated at the SRC-II demonstration facility. Distillation cuts were subjected to chemical fractionation, in vitro bioassay, and initial chemical analysis. Findings are discussed as they relate to the temperature at which various distillate cuts were produced. DOE

N82-23298# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
THE SHADOW METHOD OF PARTICLE-SIZE CALCULATION IN TWO-PHASE COMBUSTION
D. Brian Spalding Jan. 1982 29 p refs
(CFD/82/1) Avail: NTIS HC A03/MF A01

A method for calculating the local average fuel particle sizes, when fuel and gas have different velocity components at all points is presented. The method solves the equation of a shadow volume fraction of phase two particles. This shadow fraction represents the volume which would be occupied by the second phase particles if there was no mass transfer. The method was applied to a liquid propellent rocket motor, for which, when the flow is one dimensional, an exact solution of the equations exists. Good agreement with this solution is demonstrated. Computations for two and three dimensional situations are also presented in order to demonstrate the applicability of the method, to establish computer times, and to illustrate salient features of such flows. The method can be used to establish, by comparing predictions with experiments, the laws governing droplet drag or combustion. Author (ESA)

N82-23299# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.
APPLICATION OF ESCIMO TO THE TURBULENT HYDROGEN-AIR DIFFUSION FLAME
D. Brain Spalding and R. L. T. Sun Jan. 1982 37 p refs Proposed for Presentation at the 19th Combust. Symp., Haifa, Israel, Aug. 1982 Sponsored by Safety in Mines Research Estab. of UK Health and Executive Dept.
(CFD/82/2) Avail: NTIS HC A03/MF A01

A simplified version of the ESCIMO program is applied to the hydrogen-air diffusion flame and is compared with experimental data. The reaction is assumed to be laminar-diffusion controlled within the fold. Fold properties depend upon age alone, at a given point in the flame. Fold properties at birth can be deduced by tracing upstream along a line of constant mean fuel-air ratio. Fold creation rate is proportional to entrainment rate, distributed in arbitrary ways across the jet. Fold size at birth is proportional to local jet width; and the fold stretching rate is proportional to the average velocity gradient in the mean flow along the postulated trajectory. Comparisons with the experimental data show that: the agreement in respect of hydrodynamic features is good; suitable choice of input parameters permits the experimental data for unmixedness to be fitted fairly well; and the conceptual content of ESCIMO must be enlarged in order to allow for intermittency effects. Author (ESA)

N82-23300# Michigan Univ., Ann Arbor.
THEORETICAL AND EXPERIMENTAL STUDIES ON LASER LIGHT SCATTERING AND PHOTON CORRELATION SPECTROSCOPY Ph.D. Thesis
Salih Majeed Alkhafaji 1981 200 p
Avail: Univ. Microfilms Order No. 8125056

Experimentally, the molecular weight (M(w)) and temperature (T) dependence of the radius of gyration R(g), hydrodynamic radius R(h) and the second virial coefficient A2 of dilute polystyrene solutions in benzene and cyclohexane were investigated. These quantities were obtained from intensity and autocorrelation function measurements of scattered light. The temperature range is 5 C to 118 C. The results were interpreted in terms of the blob model. The theta temperature of polystyrene in benzene is in the vicinity of (0 + or - 1) C. The maximum swelling temperature T(M) above which R(g) became virtually constant was found to be T(M) approximately 98 C for polystyrene in benzene. The number of monomers in a statistical length as well as the statistical length for polystyrene were n approximately six to seven and 1 approximately 22.4 A respectively. Dissert. Abstr.

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N82-23301# Pennsylvania Univ., Philadelphia.
KINETICS OF THE DESULFURIZATION OF MOLTEN IRON Ph.D. Thesis
Apiruksa Saelim 1981 168 p
Avail: Univ. Microfilms Order No. 8127068

Experimental work involved the fabrication of impervious slipcast CaO crucibles, measurement of the rate of desulfurization of liquid iron by solid CaO and measurement of the rate of desulfurization of liquid iron by CaO saturated liquid FeO at

1800 C. The rate of desulfurization by solid CaO was determined by diffusion of sulfur in the liquid iron. Above some minimum sulfur level the activity of FeS is high enough to form a liquid phase in the system CaO-Fe-S. With lower sulfur levels CaO does not cause any desulfurization of the liquid iron. When CaO saturated liquid FeO is brought into contact with a liquid Fe-S alloy a rapid initial rate of desulfurization occurs due to surface tension, induced local convection of the slag/metal interface. After this initial period, the rate of desulfurization is determined by diffusion of sulfur in the metal. It was found that no change occurs in the oxygen content of the metal during desulfurization. Dissert. Abstr.

N82-23302# Rockwell International Corp., Golden, Colo. Energy Systems Group.

PROCESSING AND STRUCTURE OF HIGH ENERGY RATE FORGED 21-6-9 AND 304L FORGINGS

M. C. Mataya, M. J. Carr, R. W. Krenzer, G. Krauss, and G. A. Riordan, ed. 10 Aug. 1981 37 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3020) Avail: NTIS HC A03/MF A01

Two 304L and three Nitronic 40 (21-6-9) high energy rate processed forgings were studied to determine interrelationships that exist between forging history, mechanical properties, microstructure, macrostructure and substructure. A striking observation is the wide variation in properties and structure between different forgings and also between different locations within an individual forging. Variations were related to other finishing temperature of the last forming stage or to the forming sequence. For example, lower finishing temperatures resulted in higher dislocation densities; and therefore higher strengths. Higher finishing temperatures promoted dynamic recrystallization, lower dislocation densities, and lower strengths. With respect to forming sequence, locations in the forging which are formed first undergo a number of additional thermal cycles while the rest of the part is being formed. These areas are usually recrystallized and have lower dislocation densities, and therefore lower strengths relative to locations formed later in the sequence. The observation made highlight the important relationship between substructure, mechanical properties, and forging history and have put into perspective the metallurgical considerations that play a role in developing final properties. Author

N82-23303*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FATIGUE CRACK GROWTH IN 7475-T651 ALUMINUM ALLOY PLATE IN HARD VACUUM AND WATER VAPOR M.S. Thesis - George Washington Univ.

Dennis L. Dicus Nov. 1981 98 p refs
(NASA-TM-84193; NAS 1.15:84193) Avail: NTIS HC A05/MF A01

Compact specimens of 25 mm thick aluminum alloy plate were subjected to constant amplitude fatigue testing at a load ratio of 0.2. Crack growth rates were determined at frequencies of 1 Hz and 10 Hz in hard vacuum and laboratory air, and in mixtures of water vapor and nitrogen at water vapor partial pressures ranging from 94 Pa to 3.8 kPa. A significant effect of water vapor on fatigue crack growth rates was observed at the lowest water vapor pressure tested. Crack rates changed little for pressures up to 1.03 kPa, but abruptly accelerated at higher pressures. At low stress intensity factor ranges, cracking rates at the lowest and highest water vapor pressure tested were, respectively, two and five times higher than rates in vacuum. Although a frequency was observed in laboratory air, cracking rates in water vapor and vacuum are insensitive to a ten-fold change in frequency. Surfaces of specimens tested in water vapor and vacuum exhibited different amounts of residual deformation. Reduced deformation on the fracture surfaces of the specimens tested in water vapor suggests embrittlement of the plastic zone ahead of the crack tip as a result of environmental interaction. A.R.H.

N82-23304# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Dept. Etudes Mechaniques at Thermiques.

INCREMENTAL ELONGATION OR RATCHETTING: EXPERIMENTAL TESTS AND PRACTICAL METHOD OF ANALYSIS ON STAINLESS STEEL 304L

Pierre Cousseran, Jacques Lebey, Roland Roche, Gerard Clement, and Didier Moulin Dec. 1980 19 p refs In FRENCH
(CEA-N-2174) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Ratchetting (incremental elongation) can be considered as a creep enhancement when cyclic deformation are added to a primary constant load. Under examination, it appears that theoretical models proposed till now do not fit correctly the actual behavior of materials. From experimental tests results performed in Saclay, a simplified method for prevention of rachetting is proposed. A validation was made by using experimental data from various sources. DOE

N82-23305# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.

EDDY CURRENT DETECTION OF CORROSION DAMAGE IN HEAT EXCHANGER TUBES

G. VanDruen, V. S. Cecco, and J. R. Carter May 1980 29 p In ENGLISH; FRENCH summary
(AECL-6965) Avail: NTIS (US sales only) HC A03/MF A01; DOE depository Libraries

The basic principles, advantages, and shortcomings of the eddy current technique for the in-service inspection of small bore tubing are outlined. Typical eddy current indications from corrosion related defects such as stress corrosion cracks, pitting and tube denting under support plates are presented. Eddy current signals from features such as magnetite deposits and ferromagnetic inclusions which might be mistaken for defects are also discussed. DOE

N82-23306# Notre Dame Univ., Ind.

PORE SHRINKAGE AND OSTWALD RIPENING IN METALLIC SYSTEMS Annual Progress Report, 1 Jul. 1980 - 30 Jun. 1981

G. C. Kuczynski and C. W. Allen Feb. 1981 26 p refs
(Contract DE-AS02-77ER-04385)
(DE82-002771; DOE/ER-04385/5) Avail: NTIS HC A03/MF A01

The size distribution function derived by Kuczynski for the case of a system of pores in a solid matrix may be satisfactorily applied to the case of particles in a matrix as well. A wide variety of properties of this function are presented for the situation of sufficiently large average particle size for which case the function may be approximated by setting one of its terms equal to unity. For the more general situation, however, four parameters, lambda(t), n(T), A(t) and (ALPHA) (T), where t = time and T = temperature, are required to fit theory and experiment, for which several examples are presented. A variety of techniques for extracting these parameters from an empirical size distribution are being investigated. DOE

N82-23307# Rensselaer Polytechnic Inst., Troy, N. Y.

INFLUENCE OF HYDROGEN AND TEST TEMPERATURE ON MECHANICAL PROPERTIES OF VANADIUM AND NIOBIUM Final Report

N. S. Stoloff, S. Ashok, and P. Xiao 16 Oct. 1981 26 p refs
(Contract DE-AS02-76ER-03459)
(DE82-002148; DOE/ER-03459/T1; COO-3459-17) Avail: NTIS HC A03/MF A01

The influence of hydrogen on fatigue life of niobium and vanadium is described. In tests carried out under stress control conditions on unnotched material hydrogen extends fatigue life of both metals. However, in stress controlled tests on notched bars and in strain control tests on nnotched bars hydrogen is detrimental to fatigue life. Hydrided alloys are much more sensitive to notches than are the unalloyed metals. Frequency effects on fatigue life also are much more severe in hydrided alloys, lower frequency leading to shorter life. The results of delayed failure, creep tests and elevated temperature fatigue tests also are reported. Niobium and vanadium reveal reduced fatigue lives at elevated temperatures for tests carried out in vacuum. The results of limited hold time and low frequency tests on strain controlled fatigue life also are reported. Increasing hold time increases fatigue life of niobium in the range 450 to 6500 C. Fractographic features change from striations in unalloyed metals to cleavage in the hydrided alloys tested at room temperature. DOE

N82-23308# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

MECHANISMS OF THE OXIDATION OF METALS AND ALLOYS Progress Report, 1 Nov. 1980 - 31 Oct. 1981
Gregory J. Yurek 15 Sep. 1981 15 p
(Contract DE-AC02-79ER-10507)
(DE82-001585; DOE/ER-10507/2) Avail: NTIS HC A02/MF A01

The oxidation of pure Cr in H2-H2O and in H2-H2O-H2S gas mixtures was studied to delineate the mechanisms of the growth of Cr2O3 scales under reducing conditions and the influence of H2S on the growth mechanisms. Although the oxidation of Cr and Cr-bearing alloys is complex, especially when a sulfur-bearing species is present in the gas phase, insights into the fundamental mechanisms of Cr2O3 scale growth were obtained. Specimens of Fe- 6 wt% Al were prepared and stability diagrams for the Fe-Al-S-O system were calculated as preliminaries for an experiment to determine the mechanisms of the growth of Al2O3 scale in sulfur bearing gases and the reasons why Al2O3 scale is more resistant to sulfur attack than Cr2O3 scale. DOE

N82-23309# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
CARBIDE DISSOLUTION AND PRECIPITATION KINETICS OF INCONEL 600
G. P. Airey Oct. 1981 33 p refs Sponsored by EPRI
(DE82-900976; EPRI-NP-2093) Avail: NTIS HC A03/MF A01

Inconel alloy 600 steam generator tubing with different carbon contents (0.011, 0.027, 0.034, 0.048 wt%) was solution annealed in the mill annealing temperature range (927 to 10380) for times up to 30 minutes followed by a thermal treatment at 7040 C for times up to 15 hours. Grain boundary carbide percipitation and grain size were evaluated by light microscopy, scanning electron microscopy, and transmission electron microscopy, and the associated chromium depleted layer was evaluated by a modified Huey test. The amount of carbon in solution was the principal factor controlling grain boundary precipitation during thermal treatment. Prior intragranular precipitation and grain size were secondary factors. A tube temperature (982 to 10100 C) and time at temperature (1 to 5 minutes) were defined which would ensure a significant amount of grain boundary carbide precipitation following thermal treatment at 7040 C for 15 hours. These parameters also avoided the presence of an associated chromium depleted layer and undue grain growth with the resultant loss in mechanical properties. DOE

N82-23310# Battelle Columbus Labs., Ohio.
INVESTIGATION OF TECHNIQUES FOR THE PREPARATION OF HIGH-TEMPERATURE ALLOYS CAPABLE OF FORMING PROTECTIVE SILICA SCALES Final Report
V. Nagarajan and I. G. Wright Sep. 1981 36 p refs
(Contract TPS-79-731)
(DE82-900877; EPRI-PE-2034) Avail: NTIS HC A03/MF A01

A series of melting and casting techniques and powder metallurgical techniques was attempted to produce iron- and nickel-based alloys containing SiC particles. The results indicated that it is technically feasible to introduce nickel-coated SiC particles into the melt, but that the melt must be quickly cast to preserve the dispersoids. Advances in the state of the art of melting and rapid-casting methods are required to achieve good control of the SiC particle distribution. Powder metallurgical techniques provide a viable approach if a simple blending process is used to mix the powders instead of mechanica alloying. The SiC particle distribution can be controlled by choosing alloy powders of required sizes. It appears that if the SiC particles are present along the alloy grain boundaries (achieved by choosing coarse alloy powders), the oxidation resistance is excellent. Alloys containing 5% Cr and 6 to 9 wt% SiC particles have oxidation resistance comparable to that of 304 stainless steel. DOE

N82-23311# Netherlands Energy Research Foundation, Petten.
HIGH CYCLE FATIGUE PROPERTIES OF IRRADIATED AND UNIRRADIATED STAINLESS STEEL DIN 1.4949 PLATE AT 823 K
H. U. Staal Mar. 1981 30 p refs
(ECN-90) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

High cycle fatigue experiments were carried out on stainless steel DIN x 6 CrNi 1811 (Werkst. 1.4948, similar to AISI 304) in irradiated and reference condition. Specimens were irradiated at 823 K up to a fast fluence (E > 0.1 MeV) of 5 septillion sq nm and a thermal fluence of 1.6 septillion sq nm The nominal test temperature was 823 K; deviations from this nominal value were kept smaller than 3 K by avoiding too high test frequencies. A slight increase of the fatigue limit after irradiation from 152.5 MPa to 162.5 MPa is indicated. For both conditions the fatigue curve has a horizontal part for N sub f > 80 thousand cycles. Striation counts indicate that a major part of the fatigue life is consumed by initiation. As a consequence fatigue life and possibly the fatigue limit are dependent on factors which influence the initiation stage of fatigue, like surface roughness, residual stresses and defects. DOE

N82-23312# Central Research Inst. for Physics, Budapest (Hungary).
BLISTERING AND EXFOLIATION INVESTIGATIONS ON GOLD BY 3/52 MeV HELIUM PARTICLES
F. Paszti, I. Pogany, G. Mezey, E. Kotai, A. Manuaba, L. Pocs, J. Gyulai, and T. Lohner Apr. 1981 19 p refs
(DE81-700409; KFKI-1981-22) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The mechanism of blister formation was investigated on cold rolled gold target by 3.52 MeV helium ion bombardment. The critical dose was found to be 6/10(17)He( )/cm(2) under the given expermental conditions. The blisters were opened mechanically to study the inner morphology. A speculation of high energy blister formation is discussed, based on the diameter increase with sudden size changes. It is pointed out that in MeV energy region this formation could be exfoliation rather than blister formation which confirms previous investigations. DOE

N82-23313# Oak Ridge National Lab., Tenn.
TENSILE BEHAVIOR OF CF8-CPF8-304H AND CF8M-CPF8M-316H STAINLESS STEEL STATIC AND CENTRIFUGAL CASTINGS
J. W. McEnerney, V. K. Sikka, and M. K. Booker Oct. 1981 131 p refs
(Contract W-7405-eng-26)
(DE82-001958; ORNL/TM-7832) Avail: NTIS HC A07/MF A01

The tensile behavior of 11 heats of grades CF8-CPF8-304H and 13 heats of grades CF8M-CPF8M-316H static and centrifugal castings from room temperature to 6500C were analyzed. Except for anomalous conditions, the centrifugal castings exhibited uniform composition. All CPF8-304H castings had columnar, banded, or equiaxed structures. In ultimate tensile strength and total elongation the castings showed the most inferiority to wrought material. With increasing ferrite content, 0.2% yield strength and ultimate tensile strength increased while uniform elongation, total elongation, and reduction of area decreased. Although centrifugal castings did not exhibit significant end to end variation in tensile behavior, the 0.2% yield strength displayed anisotropy, with axial and circumferential values greater than radial values. DOE

N82-23314# Pontificia Universidade Catolica do Rio de Janeiro (Brazil). Dept. de Fisica.
DYNAMICAL RESPONSE OF A DISORDERED FERROMAGNETIC CHAIN ALLOY TRANSFER MATRIX APPROXIMATION
C. E. T. G. daSilva and Belita Koiller Jul. 1980 10 p refs Sponsored in part by CNPq (Brazil), Swiss National Foundation, and FINEP
(PUC-tn-15/80) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The approximation allows for a consistent treatment of diagonal and off-diagonal disorder. The results, in the limit of low concentrations, are in agreement with the exact single impurity ones. Intensities and lineshapes for infrared absorption were calculated for finite impurity concentrations and different values of the relative anisotropy parameter of a model alloy. T.M.

N82-23315# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Dept.

ENVIRONMENTAL FATIGUE OF ALUMINUM ALLOY STRUCTURAL JOINTS

R. J. H. Wanhill, J. J. deLuccia, and L. B. Vogelesang Feb. 1981 12 p refs Presented at 7th Intern. Light Metals Conf., Vienna

(NLR-MP-81013-U) Avail: NTIS HC A02/MF A01

The objectives, scope and technical requirements of a corrosion fatigue cooperative testing program are presented. The program assesses the effectiveness of systems for counteracting corrosion fatigue of aluminum alloy structural joints under realistic conditions, and studies corrosion fatigue process in order to obtain guidelines for development of protection systems. It also evaluates structural materials. Round robin tests on specimens, representing an aircraft structural joint, show that the influence of pre-exposure on fatigue life is less important than the effect of changing from air to salt spray tests. Thin sheets of 2024-T3 interleaved and adhesively bonded with single layers of aramide 143 (ARALL) were compared with monolithic 2024-T3 in fatigue tests. The ARALL specimens have fatigue lives > 20 times those of monolithic 2024-T3. Author (ESA)

N82-23316# National Bureau of Standards, Washington, D.C. Center for Building Technology.

SHORT-TERM EVALUATIAON PROCEDURES FOR COATINGS ON STRUCTURAL STEEL Final Report

Paul G. Campbell, Jonathan W. Martin, and Mary E. McKnight Sep. 1981 46 p refs Sponsored in part by Federal Highway Administration, Washington, D.C.

(PB82-123969; NBS-TN-11-49) Avail: NTIS HC A03/MF A01 CSCL 11C

Short-term test procedures for selecting coatings were reviewed and analytical measurement techniques for characterizing coating systems and for monitoring coating degradation were discussed. In assessing current accelerated aging testing procedures several deficiencies became apparent. These included the reported lack of reproducibility in the rankings for different iterations of the same short-term test and the lack of correlatability between the rankings of short-term laboratory and long-term outdoor exposure tests. GRA

N82-23317# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Structures and Materials Panel.

AN AGARD-COORDINATED CORROSION FATIGUE COOPERATIVE TESTING PROGRAMME

R. J. H. Wanhill (NLR) and J. J. DeLuccia (Naval Air Development Center, Warminster, Pa.) Feb. 1982 82 p

(AGARD-R-695; ISBN-92-835-1413-0) Avail: NTIS HC A05/MF A01

The effectiveness of state of the art protection schemes for aluminum alloys with respect to corrosion and corrosion + fatigue were assessed. The development of new protection products, procedures and techniques were considered. A common testing effort that results in a better understanding of the corrosion fatigue phenomenon and the means of mitigating it for aerospace structural materials was conducted. Fatigue capabilities were enhanced by using a controlled atmospheric corrosion environment. S.L.

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N82-23318# Akron Univ., Ohio.

EFFECT OF TEMPERATURE ON RADICAL CHAIN HOMOPOLYMERIZATION AND COPOLYMERIZATION Ph.D. Thesis

Van-Shau Liu 1982 149 p

Avail: Univ. Microfilms Order No. 8127838

The effects of reaction temperature on the homopolymerizations of methyl methacrylate, acrylonitrile and methyl acrylate, and the copolymerizations of methyl methacrylate/acrylonitrile, methyl methacrylate/methyl acrylate, and acrylonitrile/methyl acrylate were investigated using differential scanning calorimetry. The measured heats of reaction or conversions of monomer to polymer calculated from the heats of reaction decreased linearly when the reaction temperatures was increased. In the copolymerization reactions, the magnitude of the heat of reaction was also dependent upon the comonomer feed composition and the structure of the comonomer. The copolymer compositions formed at different isothermal conditions were studied by infrared spectroometry and the quantities do not follow the Mayo-Lewis copolymer composition equation and the CSMP computer program very well. Both glass transition temperatures and copolymer compositions of the polymers studied except poly(methyl methacrylate-acrylonitrile) were found to decrease with increasing reaction temperature; the reason for this exception is not clear. The ceiling temperatures for some chain growth homopolymerizations were measured by the stepwise cooling technique.

Dissert. Abstr.

N82-23319 National Physical Lab., Teddington (England). Div. of Materials Applications.

DESIGN AND TESTING OF POLYMERS AND COMPOSITES: TECHNICAL EXCHANGE PROGRAMME NUMBER 48/230

G. D. Dean Feb. 1982 50 p refs

(NPL-DMA(B)21; ISSN-0143-7313) Copyright. HC A03/MF A01

Test methods for measuring dynamic and short-term stiffness properties and long-term fracture behavior are considered. Subjects covered include: the forced nonresonance method; torsion pendulum; audio frequency resonance methods; ultrasonic methods; and constant strain rate testing. Craze initiation investigation is outlined and crack growth measurement under static and dynamic loads is dealt with. Design methodology is discussed. Author (ESA)

N82-23320*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

CHEMICAL AND RHEOLOGICAL EVALUATION OF POLYMIDES Final Report, Aug. 1980 - Sep. 1981

M. Maximovich, A. Wereta, and R. Galeos May 1982 61 p refs

(Contract NAS1-16287)

(NASA-CR-165817; NAS 1.26:165817; MSC-D831904) Avail: NTIS HC A04/MF A01 CSCL 11I

Chemical and rheological evaluation techniques were developed for polyimide composite matrix resins. LARC 160 (AP-22), LARC 160 (Curithane 103), PMR 15 and PISO2 resins were investigated. Liquid and solid state rheological techniques were used to develop processing parameters and woven graphite reinforced laminates were successfully fabricated, using these processing parameters. Author

N82-23321# Korean Atomic Energy Research Inst., Seoul.

STUDY ON THE PREPARATION OF HEAT SHRINKABLE POLYETHYLENE FILM

H. C. Pyun, K. C. Kim, B. M. Yoon, and Y. C. Lee 1980 27 p refs In KOREAN; ENGLISH summary

(KAERI-411/RR-144/80; KR8000099) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

A heat shrinkable polyethylene film was prepared by radiation. The effects of stretch ratio, radiation dosage, stretch temperature, and velocity on percent shrinkage of the stretched film were studied. Percent shrinkage increased with increasing stretch ratio and radiation dosage. The resin which has a high melt index shows higher shrinkage property and more effective elastic memory by irradiation. The resin having a low melt index, and is elongated slowly, has more increased percent shrinkage property especially in case of the resin with a low melt index, sufficient thermal conditions are needed for easy elongation. The effects of crosslinking agents and various stabilizers on the radiation crosslinking of polyvinyl chloride were studied. Triallyl cyanurate as a crosslinking agent shows a considerable gel promoting effect and maximum gel fraction at the concentration of 20 PHR, marking 85% at 14 Mrad. Butyl tin maleate complex as a liquid state stabilizer has better stabilization effects against radiation than tribasic lead sulfate as a solid state one. DOE

N82-23322# Atomic Energy Research Inst., Seoul (South Korea).

RADIATION GRAFTING OF FLAME RETARDANTS ONTO

POLYESTER/COTTON BLEND FABRIC BY ELECTRON BEAMS
J. H. Choi, J. K. Lee, Y. K. Kong, and H. S. Chang 1980 52 p refs Partly in ENGLISH, partly in KOREAN
(KAERI-396/RR-129/80) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

When the various flame retardants were grafted onto polyester/cotton (65/35) blend fabric at room temperature, the graft % was increased with the increase of radiation dosages. The great % of flame retardants at low dose rate is higher than that of flame retardants at high dose rate. High grafting efficiency was obtained with that irradiated by a mutual method and then cured 1200 C for 10 minutes. In the case of fyral 76 mixture solution, the rate of grafting (%/sec) was proportional to the power 0.75 for dose intensity and in 2-bromoethyl acrylate/bis (2-chlorethyl) vinyl phosphonate (40/60) the rate of grafting was proportional to the power 0.96 for dose intensity. DOE

N82-23323# Atomic Energy Research Inst., Seoul (South Korea).
PREPARATION OF UNSATURATED ACRYLIC PREPOLYMER AND ELECTRON BEAM CURING OF ITS MIXTURE WITH VINYL MONOMERS
H. C. Pyun, W. B. Park, K. Y. Kim, and K. Y. Sung 1980 21 p refs Partly in ENGLISH, partly in KOREAN
(KAERI-413/RR-146/80) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Electron beam curable prepolymers were prepared by the addition reaction of methyl methacrylate glycidyl methacrylate copolymer with methacrylic acid. Electron beam curing was studied for the prepolymer and their mixtures of several kind of vinyl monomers. When the reaction was carried out in the presence of triethyl benzyl ammonium chloride in N,N dimethyl formamide solution, the rate of addition reaction obeyed first order kinetics. In the electron beam curing, the rate of gel formation of the prepolymer was slower than that of the mixtures of prepolymer and monomers. In the curing of mixtures of prepolymer with polyethylene glycol dimethacrylates, the rate of gel formation increased with the increase in the degree of polymerization of polyethylene oxide fraction of polyethylene glycol dimethacrylate, and decreased with the increase the polyethylene glycol dimethacrylate content. The properties of cured coatings were also examined. DOE

N82-23324# Research Inst. of National Defence, Stockholm (Sweden).
INFLUENCE OF PROPORTION AND TYPE OF FILLERS AND SOFTENERS ON THE PROPERTIES OF CONVENTIONAL STYRENE-BUTADIENE RUBBERS [INVERKAN AV HALT OCH TYP FYLLMEDEL OCH MJUKGOERARE PAA EGENSKAPERNA HOS KONVENTIONELLT STYRENBUTADIENGUMMI]
Tord Aaredal Dec. 1981 59 p refs In SWEDISH
(FOA-C-20434-E4) Avail: NTIS HC A04/MF A01

The correlation between the damping properties and the composition of a styrene-butadiene rubber material, based on the polymer 24% styrene and the rest butadiene, was investigated. Different types of rubber with different filters (SAF, HAF, graphite) and softeners (Nysolvex 125 and D05) were tested. The static properties, freezing temperature and the complex elastic modulus (3.5 to 110 Hz, -50 +50 C) were determined. The effect of vibration amplitude on the elastic modulus was studied. Freezing temperature was measured with a differential scanning calorimeter and an extensometer, while the complex elastic modulus and the loss factor were determined in a direct readout dynamic viscoelastometer. Micrographs, taken with an electron microscope, of three of these rubber materials are presented.
Author (ESA)

N82-23325# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Verbundstrukturen.
A METHOD OF CALCULATION FOR THE MULTISTAGE DRYING PROCESS FOR PLASTICS MATERIAL
Harald Twardy May 1981 21 p ref In GERMAN; ENGLISH summary
(DFVLR-Mitt-81-29) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 7.35

A method for calculating desorption in a rapid drying process where the temperature is increased stepwise in order to avoid damage to hygroscopical plastics, was developed. In such processes, the moisture content can not be calculated by the classical desorption equation based on the assumption that the water vapor diffusion coefficient is constant. With this method, the desorption for each step of the process can be calculated by introducing an auxiliary variable of the classical method to determine the desorption evolution, although a nonconstant diffusion coefficient determines the drying process. Author (ESA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N82-23326# Westinghouse Electric Corp., Madison, Pa. Synthetic Fuels Div.
WESTINGHOUSE COAL-GASIFICATION COMBINED-CYCLE PRELIMINARY PLANT EVALUATION FOR ELECTRIC-UTILITY APPLICATIONS Final Report, 30 Sep. 1979 - 30 Jun. 1981
F. Gigliotti, R. M. Stavsky, R. Chetty, R. Garland, R. Benge (Dravo Corp.), and F. Krahulik (Dravo Corp.) 30 Jun. 1981 133 p refs
(Contract DE-AC01-79ET-14672)
(DE82-002701; DOE/ET-14672/T1) Avail: NTIS HC A07/MF A01

An evaluation design study for electric utility application is presented. Process descriptions, cost estimates and flow diagrams are based on a plant configuration incorporating an air-blown fluidized bed gasification system, a combustion turbine system, and a reheat steam turbine system for the bottoming cycle. Scoping evaluations indicated that a plant capacity of approximately 650 megawatts electric net represents an appropriate plant size from an efficiency, as well as from a utility, point of view. Various cases are analyzed to determine the effect of plant configuration and equipment on the overall plant heat rate and annual bus bar costs. A heat rate of 8340 Btu per kilowatt hour is projected for a plant case that fully integrates the power cycle with the entire gasification process and assumes that 10000 F superheated steam is generated in the gasifier raw gas heat exchanger area. Other cases relecting less integration and lower superheated steam conditions are also presented. Heat rates and economics of conventional coal fired steam plants with stack gas scrubbers are provided for comparison. The system is projected to have efficiency and economic advantages over a conventional coal fired steam plant with stack gas scrubbers.
DOE

N82-23327# California Univ., Livermore. Lawrence Livermore Lab.
PROCESS FOR UNDERGROUND GASIFICATION
R. I. Antonova and E. V. Kreinin Aug. 1981 18 p Transl. into ENGLISH of Belgian Patent no. 840,283 (1 Oct. 1976)
(Contract W-7405-eng-48)
(DE82-000493; UCRL-Trans-11720) Avail: NTIS HC A02/MF A01

An underground coal gasification process to obtain a gas having the maximum heat of combustion and to provide the capability for controlling the process is described. The underground gasification consists of a prior drainage and a gasification of a coal seam by bringing a blowing agent to the incandescent surface of the coal by means of blow holes, and vacuating the gasification products by means of a system of gas evaluation holes. The rate of the indicated gasification of the coal seam is determined as a function of natural conditions. DOE

N82-23328# System Development Corp., McLean, Va.
COMPARATIVE ANALYSIS OF PEAT GASIFICATION REACTOR CONFIGURATION Final Report
Jul. 1981 94 p refs Prepared in cooperation with UOP, Inc., McLean, Va.
(Contracts DE-AC01-78ET-10159; ET-78-C-01-3117)

(DE82-001067; DOE/ET-10159/T8) Avail: NTIS HC A05/MF A01

A comparative analysis of two generic gasifiers (fluidized bed and entrained bed) and two specific hydrogasifiers (IGT's Peat gas and Rockwell International's hydrogasifier) is presented. Mathematical models and computer programs were developed to simulate the entrained bed and fluidized bed reactors. Parametric analyses were made, using these computer programs, to test the sensitivity and effects of significant operating variables (temperature, pressure, and feed gas composition) on the product composition. The two stage Peatgas process appears to have advantages in higher thermal efficiency, smaller capital investment, and its application of existing commercial operations and proven design practices from other types of fluidized solids processing units. There are two problems concerning operability of the Peatgas process; the design of a fluidized solids unit for quite low standpipe densities, and the potential problem of ash sintering in the very hot combustion zone of the steam oxygen gasifier. On a relative time scale of development, the Peatgas would seem to be much closer to possible early commercialization than is the Rockwell system. DOE

N82-23329# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

COAL-HYDROGASIFICATION PROCESS DEVELOPMENT, GOVERNMENT FISCAL YEAR 1981 Annual Technical Progress Report

L. P. Combs, D. Heister, M. D. Schuman, N. J. Patel, M. P. Garey, and W. T. Lee 20 Oct. 1981 170 p refs

(Contract DE-AC01-78ET-10328)

(DE82-004146; DOE/ET-10328/36; ATPR-3) Avail: NTIS HC A08/MF A01

Work performed on a coal hydrogasification process development project is described. Limited progress was made on construction of a coal feed rate integrated process development unit (IPDU) facility for conducting continuous hydrogasification tests of up to 30 days duration. A chemical kinetic model of coal particle hydropyrolysis was expanded to account for hydroconversion to a generic state of gaseous and liquid products, and this model was then used to correlate successfully carbon conversion results measured in previous flas hydropyrolysis experiments with both Kentucky No. 9 bituminous and Montana Rosebud subbituminous coals. Subsequently, that coal pyrolysis model was utilized to improve an earlier computerized model for entrained flow fluidized bed processor (FHP) coal conversion reactors. The improved model's predictions were checked against experimental conversion results and other data from 25 tests in the bituminous coal FHP data base with satisfactory agreements. Predesign process optimization and subsystem evaluations were completed. materials surveillance activities in support of the IPDU system were mainly concerned with obtaining archive specimens and data from components being fabricated, accumulating samples of alternative materials to be exposed during IPDU monitoring of key components. DOE

N82-23330# Mobay Chemical Corp., Pittsburgh, Pa.

FEASIBILITY STUDY OF MEDIUM BtU COAL GAS FOR FUEL AND FEEDSTOCK AT MOBAY'S NEW MARTINSBURG, WEST VIRGINIA PLANT

Nov. 1981 130 p

(Contract DE0-FG01-80RA-50138)

(DE82-004321; DOE/RA-50138/1) Avail: NTIS HC A07/MF A01

The use of a coal gasification process to produce medium Btu fuel gas and feedstock at Mobay's New Martinsville, West Virginia chemical plant was investigated. Using Ohio River Valley coal, the plant was designed to produce a chemical feedstock containing 93% pure H2 gas at the rate of 8,900,000 SCFD and 97.5% pure CO at a rate of 2,919,000 SCFD and a medium synthesis gas at the rate of 83,056,300 SCFD. The medium Btu synthesis gas has a heating value of 291 Btu/SCF and will be used for firing existing steam boilers. DOE

N82-23331# Miami Univ., Coral Gables, Fla. Dept. of Mechanical Engineering.

CHARACTERIZATION OF ALCOHOL/GASOLINE BLENDS AS AUTOMOTIVE FUEL: PERFORMANCE AND EMISSIONS CHARACTERISTICS

R. R. Adt, Jr., K. A. Chester, M. Harrenstien, C. N. Kurucz, J. Pappas, S. Rajan, K. t. Rhee, W. F. Spurny, and M. Swain Sep. 1981 322 p refs

(Contract DE-AS05-76CS-55216)

(DE82-000124; DOE/CS-55216/T1) Avail: NTIS HC A14/MF A01

The feasibility of using alcohol blends as a motor vehicle fuel is stuided. The effect of methanol blends on the performance and regulated emissions characteristics of a conventional, carburetted, multicylinder, automotive type engine and the effect of ethanol blends on the above mentioned performance and emission characteristics using the previously described engine are investigated. Denaturant effects on ethanol blend fueled engine performance and regulated emissions characteristics for the engine are also considered. The effect of methanol blends on the lean misfire limit, and a discussion concerning geometric distribution (in the conventional engine) are presented. DOE

N82-23332# Arkansas Grain Fuels, Inc., Blytheville.

ETHANOL PRODUCTION FACILITY FEASIBILITY STUDY

Apr. 1981 451 p

(Contract DE-FG07-80RA-50301)

(DE82-000037; DOE/RA-50301/T1) Avail: NTIS HC A20/MF A01

The feasibility of constructing a biomass ethanol plant in the northeast section of Arkansas was investigated. Detailed estimated cost information including plant capital investment and operating costs are presented. The plant is designed to meet federal, state and local regulations. It was also designed to provide its own steam and electricity using coal which will be stripped in by barge from Illinois. The market potential for both ethanol and distillers dried grains is discussed. Alcohol can be produced from corn or milo at a reasonable cost in northeast Arkansas. Production capability and environmental regulations can be met with proven technology. The proposed plant site is located near both the Mississippi River and existing railways. Raw materials are available at prices economically competitive with other locations. The potential market for ethanol appears to be the only limiting factor. DOE

N82-23333# Sverdrup and Parcel, Inc., St. Louis, Mo.

FEASIBILITY STUDY FOR AN ALCOHOL PRODUCTION PLANT FOR ARIZONA GRAIN, INC., CASA GRANDE, ARIZONA

May 1981 205 p refs

(Contract DE-FG07-80RA-50300)

(DE82-000287; DOE/RA-50300/T1) Avail: NTIS HC A10/MF A01

The feasibility of establishing and profitably operating a fuel alcohol production facility was studied. Detailed technical, financial, marketing, siting, environmental, health, safety and socioeconomic analyses are described. The final study criteria differ significantly from those originally proposed, due to changes in assumptions which occurred as the study progressed. The revised criteria more truly reflect the sponsor's needs and improve the flexibility of the proposed plant. The final criteria required investigations of two site alternatives and two feedstock alternatives. Also, two production capacities, 12 million and 15 million gallons per year, were analyzed in detail. DOE

N82-23334# US Ethanol Industries, Inc., Birmingham, Mich.

FEASIBILITY STUDY FOR A 50,000,000-GALLON-PER-YEAR ETHANOL PLANT, VOLUME 1

Feb. 1981 743 p Prepared in cooperation with Ambrose (John) and Co., Inc., West Bloomfield, Mich.

(Contract DE-FG07-80RA-50345)

(DE82-002845; DOE/RA-50345/1-Vol-1) Avail: NTIS HC A99/MF A01

The technical and economic feasibility of constructing and operating a 50,000,000 a gallon per year ethanol plant in Washtenaw County, Michigan was investigated. The factors taken into consideration were: site selection, availability of resources, and marketing considerations. Design and engineering analysis as well as financial and economic analyses are also presented. S.L.

N82-23335# US Ethanol Industries, Inc., Birmingham, Mich.

FEASIBILITY STUDY FOR A 50,000,000-GALLON-PER-YEAR

ETHANOL PLANT, VOLUME 2

Feb. 1981 651 p refs Prepared in cooperation with Ambrose (John) and Co., Inc., West Bloomfield, Mich.
(Contract DE-FG07-80RA-50345)
(DE82-002434; DOE/RA-50345/1-Vol-2) Avail: NTIS HC A99/MF A01

An assessment of the environmental feasibility of the construction and operation of a 50 million gallon per year ethanol plant in southern Michigan is presented. Six sites are under consideration for the location of the proposed ethanol production facility. Environmental considerations and political factors such as the receptivity of the community to the project and availability of an option to buy the site parcel were evaluated at the onset of the feasibility study. The Ypsilanti township site on Rawsonville Road is considered the prime site for project development. Site specific environmental factors pertaining to this Ypsilanti site are addressed. DOE

N82-23336# Systems Science and Software, La Jolla, Calif.
COMPUTER MODELING OF COAL-GASIFICATION REACTORS. VOLUME 1: EXECUTIVE SUMMARY Final Report, Jun. 1975 - Nov. 1980

P. J. Chen, G. P. Schneyer, E. W. Peterson, T. R. Blake, J. L. Cook, and D. H. Brownell, Jr. Apr. 1981 73 p refs
(Contract DE-AC21-76ET-10242)
(DE82-000768; DOE/ET-10242/T1-Vol-1; FE-1770-75-Vol-1; SSS-R-81-4814-Vol-1) Avail: NTIS HC A04/MF A01

A five-year effort to study the computer modeling of coal gasification reactors is summarized. General computer models were developed to simulate fluidized bed and entrained flow coal gasification reactors. Subsequently, they were used to simulate actual reactor environments and the resulting compared with the experimental data. An executive summary, a technical report describing the formulations and the applicatons of the computer models. User's Manuals for, respectively, the fluidized bed model and the entrained flow model are presented. DOE

N82-23337# Systems Science and Software, La Jolla, Calif.
COMPUTER MODELING OF COAL-GASIFICATION REACTORS. VOLUME 2: TECHNICAL REPORT Final Report, Jun. 1975 - Nov. 1980

G. P. Schneyer, E. W. Peterson, P. J. Chen, J. L. Cook, D. H. Brownell, Jr., and T. R. Blake Apr. 1981 143 p refs
(Contract DE-AC21-76ET-10242)
(DE82-009767; DOE/ET-10242/T1-Vol-2; PE-1770-75-Vol-2; SSS-R-81-4826-Vol-2) Avail: NTIS HC A07/MF A01

The theories and numerical formulations used in developing transient, multidimensional numerical models of both fluidized bed and the entrained flow coal gasification reactors are described. The applications of two developed computer models to the simulation of actual reactor processes are discussed. Results of these computer simulations are compared with available experimental data. DOE

N82-23338# Systems Science and Software, La Jolla, Calif.
COMPUTER MODELING OF COAL-GASIFICATION REACTORS. VOLUME 3: USER'S MANUAL OF CHEMFLUB: A NUMERICAL MODEL FOR FLUIDIZED BED GASIFIERS (PLANAR AND AXISYMMTRIC VERSIONS) Final Report, Jun. 1975 - Nov. 1980

P. J. Chen Apr. 1981 126 p refs 4 Vol.
(Contract DE-AC21-76ET-10242)
(DE82-000766; DOE/ET-10242/T1-Vol-3; FE-1770-75-Vol-3; SSS-R-81-5009-Vol-3) Avail: NTIS HC A07/MF A01

The CHEMFLUB code was designed to provide predictions of the transient, two-phase, reactive flow fields occurring in a fluidized bed coal gasification reactor. CHEMFLUB can be operated in either two dimensional Cartesian (planar) or axisymmetric geometry. The solid particle phase is treated in a Lagrangian manner in order to maintain sharp interfaces around bubbles and at the freeboard while the gas phase is treated using an Eulerian approach. A detailed chemistry model, encompassing both heterogeneous and homogeneous eactions of both combustin and gasification, is included in the model. Thus, the computer model CHEMFLUB incorporates the coupled dynamic effects of the hydrodynamic, thermodynamic, and chemical phenomena which dominate flow in most fluidized bed coal gasifiers. Detailed dicussions of the governing equations are given. A summary of the governing differential, and constitutive equations is given and a brief description of the code, including a flow chart, subroutine structure, and dimension parameters as well as a detailed input sequence are presented. DOE

N82-23339# Systems Science and Software, La Jolla, Calif.
COMPUTER MODELING OF COAL-GASIFICATION REACTORS. VOLUME 4: OPERATING MANUAL FOR EF (ENTRAINED FLOW COAL GASIFIER) COMPUTER MODEL Final Report, Jun. 1975 - Nov. 1980

D. H. Brownell, Jr., J. L. Cook, and G. P. Schneyer Apr. 1981 112 p refs 4 Vol.
(Contracts DE-AC21-76ET-10242; EX-77-C-01-1770)
(DE82-000765; DOE/ET-10242/T1-Vol-4; FE-1770-75-Vol-4; SSS-R-81-4920) Avail: NTIS HC A06/MF A01

The EF (Entrained Flow) computer code and three auxiliary computer codes encompass, in operational terms, the computer model of entrained flow coal gasification developed by Systems, Science and Software for the Department of Energy. The primary aspects (geometry, hydrodynamics, thermodynamics, chemistry, etc.) of the computer model are encompassed in the EF computer code which, however, uses tabular information previously generated by the three small, auxiliary computer codes; CEST, COEFTAB and PVAPOR. In this users' manual, each of the four computer programs is described in terms of the theoretical background and objective of each program. A list of the subroutines in each program and their purposes, a detailed description of the program input including an example, and a copy of real program output for the same example was presented. DOE

N82-23340# Kentucky Univ., Lexington. Economic Services Dept.
STATUS OF OCCIDENTAL PETROLEUM'S COAL-OIL-MIXTURE PROGRAM: AN INDUSTRIAL-BOILER RETROFIT

M. E. Albert and R. D. Bessetta 1981 38 p refs Presented at the 20th Ann. Ky. Ind. Coal Conf., Lexington, Ky., 29 Apr. 1981
(DE82-900076; CONF-8104107-12) Avail: NTIS HC A03/MF A01

Conventional coal grinding and blending used for coal-oil-mixture preparation were investigrated. Stabilization techniques incorporated in the plant were studied. The economics for the use of COM can provide a savings sufficient to justify the retrofit for the boiler and a ROI on the facility to produce COM. The total cost difference between the cost of oil and the cost to produce COM which includes raw materials and production costs for a straight coal/oil mix with coal pulverized to 80% through 200 mesh was determined. The COM price will be based on a dollar per barrel delivered and adjusted to equivalent oil Btu's on a monthly or quarterly basis. It was concluded that COM is producible, handleable, storable and burnable. Information to minimize retrofit cost and maximize economic savings is available. Coal oil mixtures are ready to contribute dollars to the profit of each COM consuming plant. M.D.K.

N82-23341# Research Inst. of National Defence, Stockholm (Sweden).
EXTENSION OF POT LIFE OF HTPB-BASED COMPOSITE PROPELLANTS

Roland Sanden Jan. 1982 27 p refs In SWEDISH; ENGLISH summary
(FOA-C-20436-D1) Avail: NTIS HC A03/MF A01

The pot life of propellants with the binder HTPB and containing 85% ammonium perchlorate was determined with a plastograph at 58 C. The isocyanate curing agents DDI and IPDI were tested; IPDI gives longer pot life. The influence of some additives was studied. Iron containing catalysts such as Fe203 and n- butylferrocene decrease the pot life considerably. By adding organic substances which form metal complexes, the catalytic effect of iron is greatly reduced and about the same pot life is obtained as for propellants without iron. Among the substances tested, tetracycline is to be preferred both for its high efficiency and low health hazard. Author (ESA)

N82-23342# Research Inst. of National Defence, Stockholm (Sweden).
PERFORMANCE OF AMMONIUM NITRATE/FUEL OIL

EXPLOSIVES, WITH ALUMINUM ADDITION, IN UNDERWATER DETONATIONS [VERKAN AV ANFO-SPRAENGAEMNEN MED TILLSATS AV ALUMINUM VID UNDERVATTENSDETONATIONER]
Henrik Almstroem, Staffan Berglund, Bertil Hjalmarsson, and Paul Stroem Jan. 1982 106 p refs In SWEDISH
(FOA-C-20437-D4) Avail: NTIS HC A06/MF A01

The use of ammonium nitrate/fuel oil (ANFO) explosives in sea mines was investigated. Explosion tests of ANFO without or with up to 19% powdered aluminum addition, were carried out at 10 m depth. Pressure was recorded at four distances from the charge with piezoelectric tourmaline crystal gages. Results of the measurements are presented (max. pressure/time charts; specific impulse; density of energy and bubble pulse energy as functions of charge weight and distance) for different ANFO compositions. Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N82-23343# Department of Energy, Washington, D. C.
ENVIRONMENT SAFETY HEALTH AT DOE FACILITIES, FISCAL YEAR 1980 Annual Report, 1980
Jul. 1981 96 p refs
(DOE/EP-0024) Avail: NTIS HC A05/MF A01

The Department of Energy's fiscal year 1980 incidence rate per 200,000 work hours was 1.1 lost workday cases and 18.2 lost workdays. The recorded occupational illness rate, based on only 70 cases, was 0.05 cases per 200,000 work hours. Ten fatalities involving Federal or contractor employees occurred in fiscal year 1980 compared to nine for fiscal year 1979. Total reported property loss fiscal year 1980 was $7.1 million with $3.5 million attribute to earthquake damage. Fire losses totaled $421,000. The nonfire loss rate approximately doubled in fiscal year 1980. A total of 131 million vehicle miles of official vehicular travel during fiscal year 1980 resulted in 768 accidents and %535,145 in property damages. The 104,986 monitored employees received a total dose of 9040 rem in calendar year 1979. Both the total dose and the 1748 employees receiving radiation exposures greater than 1 rem in 1979 represent a continuing downward trend from the calendar year 1978 total dose of 9380 rem and the 1826 employees who received radiation exposures greater than 1 rem. A.R.H.

N82-23344*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE 16TH AEROSPACE MECHANISMS SYMPOSIUM
May 1982 343 p refs Proceedings of conf. held at Kennedy Space Center, Fla., 13-14 May 1982; sponsored in part by Calif. Inst. of Technology and Lockheed Missiles and Space Co., Inc., Sunnyvale
(NASA-CP-2221; NAS 1.55:2221) Avail: NTIS HC A15/MF A01 CSCL 12T

A technology survey of devices designed for use in space operations is presented. Technological areas covered include design of unique ground support equipment, orbiter specialized hardware, payload deployment, and positioning. For individual titles, see N82-23345 through N82-23367.

N82-23345*# Rockwell International Corp., Downey, Calif. Space Transportation and Systems Group.
BAGGIE: A UNIQUE SOLUTION TO AN ORBITER ICING PROBLEM **c16**
Louis J. Walkover *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 1-22 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

The orbiter icing problem, located in two lower surface mold line cavities, was solved. These two cavities are open during Shuttle ground operations and ascent, and are then closed after orbit insertion. If not protected, these cavities may be coated with ice, which may be detrimental to the adjacent thermal protection system (TPS) tiles if the ice breaks up during ascent, and may hinder the closing of the cavity doors if the ice does not break up. The problem of ice in these cavities was solved by the use of a passive mechanism called baggie, which is purge curtain used to enclose the cavity and is used in conjunction with gaseous nitrogen as the local purge gas. The baggie, the final solution, is unique in its simplicity, but its design and development were not. The final baggie design and its development testing are discussed. Also discussed are the baggie concepts and other solutions not used. Author

N82-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT SUPPORT SYSTEM MECHANISMS **c16**
In NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 23-44 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

The Flight Support System (FSS) which contains twelve mechanisms (six different types) which are used for retention and positioning of a Multimission Modular Spacecraft (MMS) within the Space Shuttle's cargo bay during launch, retrieval, and servicing missions is described. Retention latches were designed to provide the capability for structural support of the MMS during launch and retrieval, and during servicing operations the mechanisms on the Positioning Platform provide the capability for positioning the MMS in virtually any orientation necessary for the work to be performed. In addition, there are mechanisms for matching and demating umbilical connectors and a mechanism for locking the Positioning Platform during maneuvers. Each Mechanism is driven by a Common Drive Unit. Manual overrides were provided for those mechanisms that would present a safety hazard for the crew, if they should fail. Author

N82-23347*# Spar Aerospace Products Ltd., Toronto (Ontario).
THE DESIGN AND DEVELOPMENT OF AN END EFFECTOR FOR THE SHUTTLE REMOTE MANIPULATOR SYSTEM **c16**
Robert G. Daniell and Savi S. Sachdev *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 45-62 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

The design requirements, the design, and qualification and development test problems encountered on the Remote Manipulator End Effector are described. The constraints and interfaces with the arm, the Orbiter, and the payload are identified. The design solution to meet the requirements is a unique device that provides a soft-docking feature termed capture and a hard-docking feature termed rigidization. Author

N82-23348*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CENTERLINE LATCH TOOL FOR CONTINGENCY ORBITER DOOR CLOSURE **c16**
Robert C. Trevino *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 63-85 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

The centerline latch tool was designed and developed as an EVA manual backup device for latching the Space Shuttle Orbiter's payload bay doors for reentry in case of a failure of the existing centerline latches to operate properly. The tool was designed to satisfy a wide variety of structural, mechanical, and EVA requirements. It provides a load path for forces on the payload bay doors during reentry. Since the tool would be used by an EVA crewmember, control, handgrips, operating forces, and procedures must be within the capabilities of a partially restrained, suited crewmember in a zero-gravity environment. The centerline latch tool described was designed, developed, and tested to meet these requirements. Author

N82-23349*# General Electric Co., Philadelphia, Pa. Space Systems Operations Dept.
DEVELOPMENT OF AN ULTRA-LOW-SHOCK SEPARATION NUT **c37**
William Woebkenberg, Donald N. Matteo, and Vaughn D. Williams (Hi-Shear Corp., Torrance, Calif.) *In* NASA. Kennedy Space Center Center The 16th Aerospace Mech. Symp. May 1982 p 87-98 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The technical problems encountered in the development of an advanced separation nut design are described. The nut is capable of sustaining a large preload and releasing that load with a low level of induced pyrotechnic shock, while demonstrating a tolerance for extremely high shock imposed by other pyrotechnic devices. The analysis of the separation nut was performed to acquire additional understanding of the phenomena affecting operation of the nut and to provide quantitative evaluation of design modification for aerospace applications. M.D.K.

N82-23350*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Mechanisms and Separation Analysis Group.
A BALL TRUNNION CAPTURE LATCH c37
David V. Adams and Brendan Alchorn *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 99-107 ref (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The Ball Trunnion Capture Latch described was developed and designed to restrain a spacecraft deployable appendage in three translational directions. The latch is capable of supporting an appendage during STS ascent and landing events and is capable of releasing and restowing an appendage distorted in three translational directions by thermal growth. The requirements, design, analyses, and tests conducted on a development unit of the latch are discussed. M.D.K.

N82-23351*# Hughes Aircraft Co., El Segundo, Calif. Space Sensors Div.
A MOVABLE STOP MECHANISM FOR THE SIRE TELESCOPE c37
R. E. Tweedt and Robert N. Poulsen *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 109-121 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A movable stop mechanism (MSM) designed to activate flaps that change the size and shape of a telescope aperture stop on command is described. Operating at the cryogenic temperatures of the optical system, it consists primarily of a rotary solenoid that drives (activates) dual four-bar linkages in synchronism that in turn rotate the butterfly flaps into position. The design, performance characteristics, and testing of this mechanism are discussed. Specific problems that occurred during testing and the solutions that were adopted are also described. Author

N82-23352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DUAL DRIVE ACTUATORS c37
Douglas T. Packard *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 123-141 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A new class of electromechanical actuators is described. These dual drive actuators were developed for the NASA-JPL Galileo Spacecraft. The dual drive actuators are fully redundant and therefore have high inherent reliability. They can be used for a variety of tasks, and they can be fabricated quickly and economically. Author

N82-23353*# Societe Europeenne de Propulsion, Vernon (France).
DESIGN ASPECTS OF A SOLAR ARRAY DRIVE FOR SPOT, WITH A HIGH PLATFORM STABILITY OBJECTIVE c37
Jacques Cabillic, J. P. Fournier, P. Anstett, M. Souliac, and G. Thomin (CNES) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1981 p 143-157 Prepared in cooperation with MATRA (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A solar array drive mechanism (MEGS) for the SPOT platform, which is a prototype of a multimission platform, is described. High-resolution cameras and other optical instruments are carried by the platform, requiring excellent platform stability in order to obtain high-quality pictures. Therefore, a severe requirement for the MEGS is the low level of disturbing torques it may generate considering the 0.6 times 10 to the minus 3 power deg/sec stability required. The mechanical design aspects aiming at reducing the mean friction torque, and therefore its fluctuations, are described as well as the method of compensation of the motor imperfections. It was concluded, however, that this is not sufficient to reach the stability requirement. M.D.K.

N82-23354*# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
DEVELOPMENT OF A HIGH STABILITY POINTING MECHANISM FOR WIDE APPLICATION c37
A. J. D. Brunnen and R. H. Bentall (European Space Agency) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 159-173 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A recurrent requirement of spaceborne instruments and communications equipment is that of accurate pointing. This need is recognizable in such diverse applications as Star Sensor trimming, Momentum Wheel gimballing, in-orbit adjustment or alignment of equipment, inter-satellite communication and Antenna Pointing. A pointing mechanism of novel design having several advantages over the more conventional gimbal, centre-pivoted, or cross axis pointing concepts is described. Author

N82-23355*# Aerospace Corp., Los Angeles, Calif. Vehicle Engineering Div.
COMPUTER-AIDED DESIGN AND ANALYSIS OF MECHANISMS c37
Frank L. Knight *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 175-188 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

An introduction to the computer programs developed to assist in the design and analysis of mechanisms is presented. A survey of the various types of programs which are available is given, and the most widely used programs are compared. The way in which the programs are used is discussed, and demonstrated with an example. Author

N82-23356*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering Dept.
ESTIMATION OF BEARING CONTACT ANGLE IN-SITU BY X-RAY KINEMATOGRAPHY c37
Peter H. Fowler and Frank Manders (Ball Aerospace Systems) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 189-199 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The mounted, preloaded contact angle of the structural bearings in the assembled design mechanical assembly was measured. A modification of the Turns method is presented, based upon the clarity and definition of moving parts achieved with X-ray technique and cinematic display. Contact angle is estimated by counting the number of bearings passing a given point as a function of number of turns of the shaft. Ball and pitch diameter variations are discussed. Ball train and shaft angle uncertainties are also discussed. N.W.

N82-23357*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NATIONAL GEOTECHNICAL CENTRIFUGE c35
James A. Hallam, Nans Kunz, and Wilbur C. Vallotton *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 201-210 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

A high G-ton centrifuge, able to take a 2700 kg (6000 lb) payload up to 300 G, is described. The stability of dams and embankments, the bearing capacity of soil foundations, and the dynamic behavior of foundations due to vibration of machinery are examples of applications. A power rating of 6,000 kW (9,000 hp) was established for the motor. An acceptable maximum speed of 70 rpm was determined. A speed increase with a ratio of 1:3 is discussed. The isolated tension straps, the anti-spreader bar and the flexwall bucket, and safety precautions are also discussed. N.W.

N82-23358*# Ford Aerospace and Communications Corp., Palo Alto, Calif. Systems Analysis Dept.
DESIGN AND ANALYSIS CONSIDERATIONS FOR DEPLOYMENT MECHANISMS IN A SPACE ENVIRONMENT c37

P. L. Vorlicek, J. V. Gore, and C. T. Plescia *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 211-222 Sponsored in part by INTELSAT (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

On the second flight of the INTELSAT V spacecraft the time required for successful deployment of the north solar array was longer than originally predicted. The south solar array deployed as predicted. As a result of the difference in deployment times a series of experiments was conducted to locate the cause of the difference. Deployment rate sensitivity to hinge friction and temperature levels was investigated. A digital computer simulation of the deployment was created to evaluate the effects of parameter changes on deployment. Hinge design was optimized for nominal solar array deployment time for future INTELSAT V satellites. The nominal deployment times of both solar arrays on the third flight of INTELSAT V confirms the validity of the simulation and design optimization. Author

N82-23359*# British Aerospace Dynamics Group, Bristol (England).
A DEPLOYMENT MECHANISM FOR THE DOUBLE ROLL-OUT FLEXIBLE SOLAR ARRAY ON THE SPACE TELESCOPE c37
T. R. Cawsey *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 223-233 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A roll-out flexible array which provides more than 4 kW of power for the space telescope was developed. The Array is configured as two wings. The deployment mechanism for each wing is based on flight-proven FRUSA design. Modifications have been incorporated to accommodate an increase in size and mission requirements. The assembly and operation of the deployment mechanism are described together with environmental and functional tests results. Author

N82-23360*# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
SOLAR DRUM POSITIONER MECHANISMS c37
L. W. Briggs *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 235-247 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The need for additional power on spinning satellites required development of deployable solar arrays activated, as on a 3-axis vehicle, after separation from a booster or shuttle orbiter. Mechanisms were developed for telescopically extending a secondary 36.3 kg (80 lb.), 2.13 m (84 in.) diameter spinning solar drum for a distance of 2.0 m (80 in.) or more along the spin axis. After extension, the system has the capability of dynamically controlling the drum tilt angle about the spin axis to provide precision in-orbit balancing of the spacecraft. This approach was selected for the SBS, ANIK C, ANIK D, WESTAR B and PALAPA B satellites. It was successfully demonstrated during the in orbit deployment of the aft solar panels of the SBS F-3 and F-1 satellites, subsequent to the November 1980 and September 1981 launches. Author

N82-23361*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEPLOYMENT/RETRACTION GROUND TESTING OF A LARGE FLEXIBLE SOLAR ARRAY c44
Darius T. Chung *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 249-263 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 10A

The simulated zero-gravity ground testing of the flexible fold-up solar array consisting of eighty-four full-size panels (.368 m x .4 m each) is addressed. Automatic, hands-off extension, retraction, and lockup operations are included. Three methods of ground testing were investigated: (1) vertical testing; (2) horizontal testing, using an overhead water trough to support the panels; and (3) horizontal testing, using an overhead track in conjunction with a counterweight system to support the panels. Method 3 was selected as baseline. The wing/assembly vertical support structure, the five-tier overhead track, and the mast-element support track comprise the test structure. The flexible solar array wing assembly was successfully extended and retracted numerous times under simulated zero-gravity conditions. Author

N82-23362*# Princeton Univ., N. J. Plasma Physics Lab.
THE DEVELOPMENT OF A UNIVERSAL DIAGNOSTIC PROBE SYSTEM FOR TOKAMAK FUSION TEST REACTOR c75
Richard Mastronardi, Richard Cabral, and Dennis Manos *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 265-275 Prepared in cooperation with American Science and Engineering, Inc., Cambridge, Mass. (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 20I

The Tokamak Fusion Test Reactor (TFTR), the largest such facility in the U.S., is discussed with respect to instrumentation in general and mechanisms in particular. The design philosophy and detailed implementation of a universal probe mechanism for TFTR is discussed. Author

N82-23363*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Structures and Mechanisms Sect.
ELASTIC SUSPENSION OF A WIND TUNNEL TEST SECTION c09
Russell Hacker, Stephen Rock (Systems Control Inc., Palo Alto, Calif.), and Daniel B. DeBra (Sanford Univ.) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 277-297 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

Experimental verification of the theory describing arbitrary motions of an airfoil is reported. The experimental apparatus is described. A mechanism was designed to provide two separate degrees of freedom without friction or backlash to mask the small but important aerodynamic effects of interest. N.W.

N82-23364*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE SHUTTLE EXTERNAL TANK GASEOUS OXYGEN VENT SYSTEM c16
William G. Franklin *In its* The 16th Aerospace Mech. Symp. May 1982 p 299-313 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

Two problems had to be solved to assure successful elimination of ice on the External Tank (ET). First, an access/support structure was provided from the Launch Complex 39A Fixed Service Structure to the vicinity of the nose cone on the ET approximately 82.3 meters (270 feet) above the surface of the pad and 22.9 meters (75 feet) from the face of the FSS. Second, an umbilical was designed and tested that would seal around the ET gaseous oxygen (GOX) vent louvers and not allow ice to form on the tank or the umbilical. A modified Apollo service arm was chosen. An inflatable vent seal subsystem was chosen, providing a cloth seal around each vent louver with an internal annulus to provide a path for the gaseous oxygen from the ET to a hard duct on the swing arm. N.W.

N82-23365*# Lockheed Missiles and Space Co., Sunnyvale, Calif. RF/Antenna Systems Lab.
DESIGN, DEVELOPMENT AND MECHANIZATION OF A PRECISION DEPLOYABLE TRUSS WITH OPTIMIZED STRUCTURAL EFFICIENCY FOR SPACEBORNE APPLICATIONS c14
N. D. Craighead, Timothy D. Hult, and Richard J. Preliasco *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 315-328 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

A deployable mast concept which meets the weight, size and stability requirements for a feed support structure for offset antennas up to 100 meters in diameter is discussed. A triangulated truss configuration, the use of tapered tubes which exhibit a high strength-to-weight ratio, and low CTE graphite-epoxy material are seen to provide an efficient, lightweight and stable truss suitable for an antenna feed support. A low stowage ratio of 30:1 is achieved through a unique preloaded hinge located at the center of each longeron and an autonomous deployment cage with a drive mechanism. Initial analysis and proof of concept

hardware validated the basic mechanism and design assumptions and provided a basis for further investigation. The concept can readily accept variations in member size and thus lends itself to optimization for other potential uses where a stiff, lightweight deployable truss is needed. Author

N82-23366*# Federal Aircraft Establishment, Emmen (Switzerland). Thermodynamics Sect.

THE MECHANICAL DESIGN OF A VAPOR COMPRESSOR FOR A HEAT PUMP TO BE USED IN SPACE c34

Felix Berner, H. Oesch, K. Goetz, and C. J. Savage (ESA) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 329-340 refs (For primary document see N82-23344 14-31)

Avail: NTIS HC A15/MF A01 CSCL 20D

A heat pump developed for use in Spacelab as a stand-alone refrigeration unit as well as within a fluid loop system is discussed. It will provide an active thermal control for payloads. Specifications for the heat pump were established: (1) heat removal rates at the source; (2) heat source temperatures from room temperature; (3) heat-sink fluid temperatures at condenser inlet; and (4) minimum power consumption. A reversed Carnot cycle heat pump using Freon 12 as working fluid incorporating a one-cylinder reciprocating compressor was selected. The maximum crankshaft speed was fixed relatively high at 100 rpm. The specified cooling rates then made it necessary to select a cylinder volume of 10 cu cm, which was obtained with a bore of 40 mm and a stroke of 8 mm. N.W.

N82-23367*# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.

DESIGN OF A 7kW POWER TRANSFER SOLAR ARRAY DRIVE MECHANISM c37

J. G. Sheppard *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 341-350 refs (For primary document see N82-23344 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13I

With the availability of the Shuttle and the European launcher, Ariane, there will be a continuing trend towards large payload satellite missions requiring high-power, high-inertia, flexible solar arrays. The need arises for a solar array drive with a large power transfer capability which can rotate these solar arrays without disturbing the satellite body pointing. The modular design of such a Solar Array Drive Mechanism (SADM) which is capable of transferring 7kW of power or more is described. Total design flexibility has been achieved, enabling different spacecraft power requirements to be accommodated within the SADM design. Author

N82-23368# Mid-American Solar Energy Complex, Minneapolis, Minn.

AUDIO-VISUAL SUMMARY OF PASSIVE SOLAR COMMERCIAL BUILDINGS DEVELOPMENT IN THE MASEC REGION

Aug. 1981 10 p

(Contract DE-AC02-79CS-30151)

(DE82-003136; MASEC-R-81-039; P-104-2) Avail: NTIS HC A02/MF A01

An audio-visual presentation documenting the use of passive solar technologies in commercial buildings within the Mid-American Region is summarized. The presentation consists of 50 35-millimeter slides with accompanying narrative. The slide show gives a brief introduction to the use of direct gain, indirect gain, and isolated gain systems with commercial examples of each. DOE

N82-23369# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

ON THE CLEANING OF SEWAGE PIPES WITH THE HELP OF CONVECTED SPHERES (5TH SERIES OF EXPERIMENTS)

A. Dinkelacker Jul. 1981 64 p refs In GERMAN; ENGLISH summary

(MPIS-11/1981; ISSN-0436-1199) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13,35

Cleaning municipal sewage pipes with the help of spheres which are moved through the pipes by the flow of sewage was undertaken. In order to investigate the applicability of the method, several series of experiments were performed in the sewage pipe system of the city of Hanover. The fifth series of these experiments is concerned with checking whether or not it is possible to prevent mud sedimentation in a newly cleaned sewage pipe with the help of daily throughput of spheres. The experiments were performed with spheres 0.56 m in diameter in a sewage pipe 1.4 m in diameter under normal conditions of sewage flow. Over a period of nine weeks, three runs per working day were made with a sphere. Measurements of mud sedimentation in the pipe show that practically no sedimentation occurred during the cleaning runs and that considerable sedimentation occurred in a comparison period without runs. Author (ESA)

N82-23370# Anderson and Berdie Associates, Inc., St. Paul, Minn.

THE ENERGY EFFICIENT BUILDING PROGRAM NEEDS ASSESSMENT

Mar. 1981 90 p Sponsored in part by Minn. Energy Agency (PB82-124173; MEA-8-81) Avail: NTIS HC A05/MF A01 CSCL 13L

A needs assessment to provide a better understanding of the decisions that determine the energy efficiency of new buildings and to determine how those decisions may be influenced is discussed. The needs assessment is to provide information and guidance for the development and implementation of educational programs to improve energy efficiency of new building design and construction in Minnesota. This also includes the present practice of energy efficiency in new building design and construction, the barriers preventing design and construction aimed toward energy efficiency, the types of information that can be provided to assist in improving new building energy efficiency, and the most productive delivery mechanisms for such information. GRA

N82-23371# Transportation Research Board, Washington, D.C.

LAYERED PAVEMENT SYSTEMS

1981 88 p refs

(PB82-131368; TRB/TRR-810; LC-81-1877; ISBN-0-309-03251-2; ISSN-0361-1981) Avail: NTIS HC A05/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC 20418 CSCL 13B

Numerous aspects of the mechanical and structural response of layered pavement systems are discussed. Subgrade moduli for soil that exhibits nonlinear behavior are predicted. The use of a pressure meter test to predict modulus is discussed. Load equivalency factors of triaxial loading for flexible pavements is discussed, as well as a constitutive equation for the permanent strain of sand subjected to cyclic loading. GRA

N82-23372# Texas Univ. at Arlington. Center for Transportation Research.

BEHAVIOR OF POST-TENSIONED GIRDER ANCHORAGE ZONES Interim Research Report

W. C. Stone, W. Paes-Filho, and J. E. Breen Apr. 1981 280 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation

(PB82-124371; FHWA/TX-81/8-208-2; CTR-3-5-77-208-2) Avail: NTIS HC A13/MF A01 CSCL 13B

Several large, thin-webbed box girder bridges, with post-tensioned anchorage zones have experienced large cracks along the tendon path in the anchorage zones at the design stressing load. A simplified test specimen was developed to accurately simulate the behavior of the post-tensioned box girder web. The primary variables affecting the formation of the tendon path crack were investigated: tendon inclination and eccentricity, section height and width, tensile splitting strength of the concrete, anchor width and geometry, and the effect of supplementary anchorage zone reinforcement, both active and passive. Behavioral trends are presented as determined from three sources. These include physical tests of 40 quarter-scale microconcrete models and physical tests of 9 full-scale prototype box girder web sections. Author (GRA)

N82-23373# Solar Turbines International, San Diego, Calif.

HIGH TEMPERATURE METALLIC RECUPERATOR Annual Report, May 1980 - Apr. 1981

Michael E. Ward, Neil G. Solmon, and Charles E. Smeltzer Jun.

1981 130 p refs Sponsored by Gas Research Inst.
(PB82-141102; SR81-R-4861-15; GRI-80/0074) Avail: NTIS HC A07/MF A01 CSCL 13A

An industrial 4.5 MM Btu/hr axial counterflow recuperator, fabricated to deliver 1600 F combustion air, was designed to handle rapid cyclic loading, a long life, acceptable costs, and a low maintenance requirement. A cost benefit anlysis of a high temperature waste heat recovery system utilizing the recurperator and components capable of 1600 F combustion air preheat shows that this system would have a payback period of less than two years. Fifteen companies and industrial associations were interviewed and expressed great interest in recuperation in large energy consuming industries. Determination of long term environmental effects on candidate recuperator tubing alloys was completed. Alloys found to be acceptable in the 2200 F flue gas environment of a steel billet reheat furnace, were identified. GRA

N82-23374# Transport and Road Research Lab., Crowthorne (England).
RECOMMENDATIONS FOR ROAD SURFACE DRESSING
HMSO 1981 29 p refs
(PB82-132630; ROAD-NOTE-39; ISBN-0-11-550554-7) Copyright. Avail: NTIS HC A03/MF A01 CSCL 13C

Guidance is provided for the preparation of specifications needed to cater to the wide range of traffic conditions and types of surfaces likely to be encountered on country lanes as well as other motorways. Both chippings and binders are considered as well as their application. Topics covered include surface preparation; application of the binder; spraying time; joining strips of sprayed binder; applying chips; rolling; and traffic management during and after operations. Special areas discussed include heavily trafficked high speed roads; hard shoulders; open-textured and porous bituminous surfaces; unbound surfaces; sealing roadbases, subgrades, and subbases; bituminous mist sprays; high stressed sites (epoxy resin based systems); the treatment of fatted surface dressings; and the control of materials and workmanship. Procedures for measuring hardness, and the rate of spread of spray binders and of chippings are included. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N82-23375# Clemson Univ., S.C.
CUT-OFF RATE EVALUATION OF DIGITAL COMMUNICATION SYSTEMS Ph.D. Thesis
Athanasios Aridgides 1981 87 p
Avail: Univ. Microfilms Order No. 8126921

The cut-off rate (R sub o) is used as a criterion for overall communication system design, leading to the systematic design of soft decision demodulators. The R sub o expressions for freqeuncy shift keying, phase shift keying, and continuous phase frequency shift keying are developed, assuming an additive white Gaussian noise channel, and the equivalence of R sub o and probability of error for hard decisions is demonstrated. The system performance improvement of soft decision demodulators is also demonstrated. In particular, for continuous phase frequency shift keying it is shown that the R sub o criterion aids directly in the selection of the observation interval length, frequency deviation ratio, and the number of demodulator soft decision levels. The R sub o expressions fo channels other than the additive white Gaussian channel are developed, in particular the Rayleigh fading channel and the Rician fading channel. It is shown that eight level quantization yields performance within a few tenths of a dB of the unquantized (optimum) performance. Tradeoffs between diversity and the number of quantization levels for equivalent performance are presented as a function of signal to noise ratio using the R sub o expressions for the unquantized and quantized channels. Dissert. Abstr.

N82-23376* National Aeronautics and Space Administration. Pasadena Office, Calif.
ECHO TRACKER/RANGE FINDER FOR RADARS AND SONARS Patent
Nick J. Constantinides, inventor (to NASA) (JPL, California Inst. of Tech., Pasadena) Issued 16 Mar. 1982 10 p Filed 29 Jun. 1979 Supersedes N79-26253 (17 - 17, p 2249)
(NASA-Case-NPO-14361-1; US-Patent-4,320,397; US-Patent-Appl-SN-053572; US-Patent-Class-343-7.5; US-Patent-Class-343-5DP; US-Patent-Class-343-17.1PF; US-Patent-Class-356-5; US-Patent-Class-367-95) Avail: US Patent and Trademark Office CSCL 20N

An echo tracker/range finder or altimeter is described. The pulse repetition frequency (PFR) of a predetermined plurality of transmitted pulses is adjusted so that echo pulses received from a reflecting object are positioned between transmitted pulses and divided their interpulse time interval into two time intervals having a predetermined ratio with respect to each other. The invention described provides a means whereby the arrival time of a plurality of echo pulses is defined as the time at which a composite echo pulse formed of a sum of the individual echo pulses has the highest amplitude. The invention is applicable to radar systems, sonar systems, or any other kind of system in which pulses are transmitted and echoes received therefrom. M.D.K.

N82-23377 British Broadcasting Corp., Kingswood (England). Research Dept.
A NEAR FIELD METHOD FOR CALIBRATING L.F./M.F. FIELD STRENGTH MEASURING RECEIVES
A. P. Robinson Feb. 1982 10 p refs
(BBC-RD-1982/1) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The method involves setting up a short vertical monopole on the ground in an open space. There is an accurate solution for the electromagnetic field at any point, transmitted from the monopole. It is possible to calibrate both electric and magnetic field detectors, and to calibrate an antenna mounted on a vehicle. The practical aspects are covered in detail. T.M.

N82-23378 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
TROPOSCATTER DISPERSION MEASUREMENTS WITH ANGLE DIVERSITY IN TWO FREQUENCY BANDS
F. Schmitt Oct. 1981 53 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF-80)
(Rept-10-18; Lfd-194) Copyright. Avail: Issuing Activity

Measurements of received signal level as well as of multipath dispersion were carried out over a 278 km troposcatter test link. The tests were performed simultaneously in two frequency bands (UHF: 900 MHz, C-band: 4.478 GHz), using receiving channels and a combined angle diversity antenna with two diversity beams in UHF and four diversity beams in C-band. A correlation factor of 0.3 between the temporal evolution of the signal of both UHF channels was measured. A statistical analysis of the time of flight measurements (delay spread and Doppler spread) was made. The Doppler spread is clearly frequency dependent. The statistical correlation between the relative amplitude variation of the received signal and the delay spread shows a decrease of the amplitude variation with higher delay spread. The delay spread can not be determined from the amplitude variations. Author (ESA)

N82-23379*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF SIGMA(o) OBTAINED FROM THE CONVENTIONAL DEFINITION WITH SIGMA(o) APPEARING IN THE RADAR EQUATION FOR RANDOMLY ROUGH SURFACES
D. M. LeVine Feb. 1981 24 p refs
(NASA-TM-82092; NAS 1.15:82092) Avail: NTIS HC A02/MF A01 CSCL 20N

A comparison is made of the radar cross section of rough surface calculated in one case from the conventional definition and obtained in the second case directly from the radar equation. The validity of the conventional definition representing the cross section appearing in the radar equation is determined. The analysis

is executed in the special case of perfectly conducting, randomly corrugated surfaces in the physical optics limit. The radar equation is obtained by solving for the radiation scattered from an arbitrary source back to a colocated antenna. The signal out of the receiving antenna is computed from this solution and the result put into a form recognizeable as the radar equation. The conventional definition is obtained by solving a similar problem but for backscatter from an incident planewave. It is shown that these tow forms for sigma are the same if the observer is far enough from the surface. S.L.

N82-23380*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVERSE SCATTERING FOR AN EXTERIOR DIRICHLET PROGRAM
S. I. Hariharan 26 May 1981 23 p refs
(Contracts NAS1-16394; NAS1-15810)
(NASA-TM-84046; NAS 1.15:84046; Rept-81-17) Avail: NTIS HC A02/MF A01 CSCL 20N

Scattering due to a metallic cylinder which is in the field of a wire carrying a periodic current is considered. The location and shape of the cylinder is obtained with a far field measurement in between the wire and the cylinder. The same analysis is applicable in acoustics in the situation that the cylinder is a soft wall body and the wire is a line source. The associated direct problem in this situation is an exterior Dirichlet problem for the Helmholtz equation in two dimensions. An improved low frequency estimate for the solution of this problem using integral equation methods is presented. The far field measurements are related to the solutions of boundary integral equations in the low frequency situation. These solutions are expressed in terms of mapping function which maps the exterior of the unknown curve onto the exterior of a unit disk. The coefficients of the Laurent expansion of the conformal transformations are related to the far field coefficients. The first far field coefficient leads to the calculation of the distance between the source and the cylinder. S.L.

N82-23381*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EXTRAVEHICULAR ACTIVITY/AIR TRAFFIC CONTROL (EVA/ATC) TEST REPORT
Dominic J. Tomaro Feb. 1982 36 p refs
(Contract NAS9-15800)
(NASA-CR-167600; JSC-17917; NAS 1.26:167600; LEMSCO-17557) Avail: NTIS HC A03/MF A01 CSCL 17B

During extravehicular activity (EVA), communications between the EVA astronaut and the space shuttle orbiter are maintained by means of transceiver installed in the environmental support system backpack. Onboard the orbiter, a transceiver line replaceable unit and its associated equipment performs the task of providing a communications link to the astronaut in the extravehicular activity/air traffic control (EVA/ATC) mode. Results of the acceptance tests that performed on the system designed and fabricated for EVA/ATC testing are discussed. A.R.H.

N82-23382# Communications Research Centre, Ottawa (Ontario). Radar and Communications Technology Branch.
THE CRC TOPOGRAPHIC DATA
J. H. Whitteker Feb. 1982 63 p refs
(CRC-1353) Avail: NTIS HC A04/MF A01

A data base of terrain elevations and surface types primarily for providing input data for radio wave prediction programs is described. The data were derived by hand scaling 1:50000 scale topographic maps. An elevation and a surface code is stored for each point in a square array with 500 m spacing. The data reside on computer disks, and are organized for rapid access. The usual method of obtaining information from the data base is by means of a FORTRAN subroutine that provides elevations and surface codes at 500 m intervals along any specified great circle path within the data base area. The elevations may also be plotted on an ordinary alphanumeric computer terminal.
Author

N82-23383# Communications Research Centre, Ottawa (Ontario). Radar and Communications Technology Branch.
RAIN ATTENUATION STATISTICS FOR TERRESTRIAL MICROWAVE LINKS IN CANADA
B. Segal Jan. 1982 248 p refs
(CRC-1351-E) Avail: NTIS HC A11/MF A01

A broad, comprehensive set of attenuation predictions are presented for terrestrial microwave system planning. Detailed aspects of rain structure which affect the calculation of attenuation from a knowledge of the instantaneous precipitation intensities are discussed. The basis of the synthetic storm procedure which is used to compute the rain attenuation for terrestrial links is outlined. The range of microwave hop parameters for which attenuation prediction data are presented is described, and a number of current schemes for frequency extrapolation is examined. A selection of contour maps giving the attenuation levels and maximum permissible hop lengths on a geographic basis are also presented. The polarization characteristics of rain attenuation are considered. Finally, the predicted attenuation distributions for the individual locations are presented. S.L.

N82-23384# General Research Corp., Santa Barbara, Calif.
TACTICAL AIR SURVEILLANCE RADAR NETTING (TASRAN) SIMULATOR/EMULATOR Final Technical Report, Mar. 1980 - Jun. 1981
G. F. VanBlaricum Griffiss AFB, N.Y. RADC Oct. 1981 54 p
(Contract F30602-80-C-0154; AF Proj. 4506)
(AD-A110382; GRC-CR-6-994; RADC-TR-81-278) Avail: NTIS HC A04/MF A01

TASRAN is a computer simulation for evaluating netted tactical air surveillance systems. TASRAN can model user-defined networks of groundbased radars, and it can exercise this radar network against user-defined scenarios of hostile and friendly aircraft on specified flight paths. The data processing functions of radar detection, track initiation and correlation, and automatic target tracking are performed (not merely simulated) on the simulated measurements from the network of radars. Communication from site to site can be modeled in various levels of detail, from simple message routing to resource sharing and delays to detailed calculations of propagation and jamming degradation. Simulation outputs can be summarized in printed tables or in interactive displays at a Tektronix terminal. The computer program is installed on RADC's Honeywell 6180 computer system; an identical version is installed on GRC's DEC VAX-11/780, where all of the code was developed and tested. GRA

N82-23385# Ohio Univ., Athens. Avionics Engineering Center.
INVESTIGATION AND DEVELOPMENT OF VHF GROUND-AIR PROPAGATION COMPUTER MODELING INCLUDING THE ATTENUATING EFFECTS OF FORESTED AREAS FOR WITHIN-LINE-OF-SIGHT PROPAGATION PATHS Final Report
Kent A. Chamberlin Mar. 1981 183 p refs
(Contract DOT-FA78WA-4189)
(AD-A111719; OU/AEC/EER-51-1) Avail: NTIS HC A09/MF A01 CSCL 20/14

An investigation into short-distance (5-100 nm), air-ground, VHF propagation computer models is presented. An evaluation of existing propagation models is afforded by measured signal strength data, collected for this study, obtained for a variety of propagation paths; this evaluation shows existing models to be deficient due to their incapability to calculate attenuation caused by trees for within-line-of-sight propagation paths. The theory behind, and the development of, a computer model that does successfully account for tree attenuation is discussed and documented. A complete description of signal strength data collection is given detailing measurement equipment, site conditions and data reduction. Author (GRA)

N82-23386# Technology Service Corp., Silver Spring, Md.
DOPPLER SPECTRA OF RADAR CLUTTER
Wayne Rivers 30 Nov. 1981 15 p ref
(Contract N60921-80-D-A131)
(AD-A111306) Avail: NTIS HC A02/MF A01 CSCL 17/9

Radar clutter spectra having sufficient dynamic range and resolution to permit shape estimation are reviewed. All are found to be distinctly non-Gaussian. A clutter scatterer motion model that includes correlation of velocities is defined and supported by empirical data for the case of wind fields. The Doppler spectra of scatterers with correlated motions are computed. Improvement factors for binominal-weighted moving-target indicators (MTI) are

computed for several analytic spectrum functions that bound various observed features of empirical spectra. Author (GRA)

N82-23387# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
STRUCTURAL AND ELECTRICAL PERFORMANCE CONSIDERATIONS IN THE DESIGN OF MULTIBAND RADOMES
G. Dailey and R. C. Mallalieu 14 May 1981 22 p refs
(Contract N00024-81-C-5301)
(AD-A111795) Avail: NTIS HC A02/MF A01 CSCL 17/9

Multimode guidance capability is a requirement for missiles that will satisfy the Navy's near- and far-term area defense needs, which implies the use of thin walled radomes on missiles that will operate at speeds up to M8. Structural analyses were conducted to determine the minimum wall thicknesses that are required to carry the aerodynamic loadings during sea level flight at speeds from M2 to M6 undergoing a 30g maneuver. In this paper the results of the parametric loads and stress investigation are discussed. Also covered are the results of an investigation into the electrical performance of three different wall configurations for use with dual-band guidance at 3 and 5 GHz. Author (GRA)

N82-23388# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ZERO-POINT ELECTROMAGNETIC FIELD AND NONLOCALITY
Kh. Namsrai 1980 6 p refs Submitted for publication
(JINR-E-2-80-755) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The problem of the experimental test of local quantum field theory at small distances is solved. An approach related to properties of vacuum fluctuations, was used to test the locality in physics. The change of the spectral density of the zero-point electromagnetic field at small distances is very sensitive to the change of vertex functions and propagator of leptons and photons. It is shown in the case of the Lamb shift for atomic levels. Calculation of the Lamb shift within the framework of a nonlocal stochastic electrodynamics gives the restriction on the value of fundamental lengths 1 < or approximately 8x10(+18) cm. DOE

N82-23389# Engins Matra, Velizy (France).
TELECOM 1: FRENCH DOMESTIC COMMUNICATIONS SATELLITE SYSTEM
May 1981 16 p
Avail: NTIS HC A02/MF A01

Services supplied by TELECOM 1, the components of the TELECOM 1 system, the industrial organization, and the project schedule are described. The TELECOM 1 system: provides broadband digital links between companies in France and neighboring states; routes telephone communications and television broadcasts between France and its overseas territories; and handles government communications. A ground control and monitoring station operates the TDMA system and supervises ground station performance, synchronizes the bursts from each station, surveys the repeaters and provides the billing. Three satellites, including one spare, developed from OTS, MARECS and ECS designs, are launched by Ariane. Author (ESA)

N82-23390# Fondazione Ugo Bordoni, Rome (Italy).
A SIGNAL PROCESSING METHOD BASED ON A HOMOTOPIC CORRELATION PRODUCT APPLIED TO SPEECH RECOGNITION PROBLEMS
Foster Bianchi, Paolo Pocci, and Lucio Prina Ricotti Feb. 1981 5 p Presented at 4th F.A.S.E. Symp., Venice, Apr. 1981
(FUB-20-1981) Avail: NTIS HC A02/MF A01

The assumptions used to formulate the processing method, the proposed algorithm, and phoneme recognition test results of a homotopic signal processing method are presented. The hearing system is considered as a box with one imput, that applies a signal whose information content = 500 Kbit/sec, and many thousand outputs, the nerve fibers, having a transmission rate variable between 30 and 400 bit/sec. The signal transmitted by any one fiber is a series of equal impulse. Homotopic representation of a phoneme is available in steady state after 2 to 3 msec. The phoneme patterns are very different, although patterns for the same phoneme from different speakers are similar. Transition patterns between phonemes change rapidly. Recognition rate, using a minicomputer, of all possible combinations of 'a', 'e', 'r' and 'm' is 95.2%. Author (ESA)

N82-23391# Fondazione Ugo Bordoni, Rome (Italy).
SPEECH SIGNAL RECOGNITION WITH THE HOMOTOPIC REPRESENTATION METHOD
Foster Bianchi, Paolo Pocci, and Lucio Prina Ricotti Feb. 1981 6 p Presented at 4th F.A.S.E. Symp., Venice, Apr. 1981
(FUB-21-1981) Avail: NTIS HC A02/MF A01

Speech recognition by a computer, using homotopic representation, is introduced, including the algorithm and the processing mode for the speech signal, the result of a vowel recognition experiment, and the result of a phonetic transcription experiment with simple words composed of four phonemes. The signal is stored in a delay line of M elements and N = M + 1 outputs. Homotopic defines a pair of outputs symmetrical to the exit located in the central element of the delay line. When the products of sample homotopic outputs of the first sequence of pair sampling are found, they are separately summed to the products of the following processing. This procedure is repeated continuously so that at every instant the transform function is the result of the last processing and the weighted sum of the previous result. In tests a female /o/ is recognized as /a/. Of 320 test phonemes, 15 are mistaken and 7 are dubious. Author (ESA)

N82-23392# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
VLF WAVE PROPAGATION WITH AN INHOMOGENEOUS, ANISTROPIC IONOSPHERE [VLF - WELLENAUSBREITUNG MIT INHOMOGENER, ANISOTROPER IONOSPHAERE]
E. Floery Apr. 1981 59 p refs In GERMAN; ENGLISH summary
(INW-8105) Avail: NTIS HC A04/MF A01

A model of electromagnetic long wave (VLF) transmission with a highly dependent, anisotropic ionosphere is described. The propagation of VLF waves follows the Earth ionosphere conducting medium in the form of self oscillations. The characteristics of these waveguide modes are defined by the electrical and magnetic properties of the wave conductor boundaries and by the frequency band. Inhomogeneity in the ionosphere is taken into account as a continously varying, N layer slab. The differential equations are solved for several profiles of electron density and collision distribution. The model shows reflection and absorption behavior of a magnetoplasma, besides frequency dependent characteristics of damping and relative phase velocity for a realistic ionosphere. Numerical simulations were run for different VLF transmitter phases and amplitudes, then compared with measured data. Diurnal and seasonal variations in the characteristic propagation parameters show good agreement. Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N82-23393 Royal Signals and Radar Establishment, Malvern (England).
THE CALCULATION OF THE EQUIVALENT CIRCUITS OF COAXIAL-LINE STEP DISCONTINUITIES
T. E. Hodgetts 1981 47 p refs
(RSRE-Memo-3422; BR81999) Copyright. Avail: Issuing Activity

A method of calculating the equivalent circuits of discontinuities in coaxial lines caused by abrupt changes of radius in one or both of the coaxial conductors is presented. The theory was fully worked out for discontinuities of the inner conductor alone. Implementation of the final equations on a computer is described. The performance of the resulting program is discussed, including the effects of truncation error and extrapolation to infinity. The use of the theory with coaxial line reflection and transmission standards is described and a simple error analysis of these

standards is presented which shows that their performance is calculable to an accuracy limited only by the precision to which they can be made. Author (ESA)

N82-23394*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

PRELIMINARY STUDY, ANALYSIS AND DESIGN FOR A POWER SWITCH FOR DIGITAL ENGINE ACTUATORS

E. C. Beattie and H. C. Zickwolf, Jr. Sep. 1979 79 p refs
(Contract NAS3-21809)
(NASA-CR-159559; NAS 1.26:159559; PWA-5643-6) Avail: NTIS HC A05/MF A01 CSCL 09A

Innovative control configurations using high temperature switches to operate actuator driving solenoids were studied. The impact on engine control system life cycle costs and reliability of electronic control and (ECU) heat dissipation due to power conditioning and interface drivers were addressed. Various power supply and actuation schemes were investigated, including optical signal transmission and electronics on the actuator, engine driven alternator, and inside the ECU. The use of a switching shunt power conditioner results in the most significant decrease in heat dissipation within the ECU. No overall control system reliability improvement is projected by the use of remote high temperature switches for solenoid drivers. J.M.S.

N82-23395*# General Electric Co., Philadelphia, Pa. Space Div.

PRELIMINARY DESIGN DEVELOPMENT OF 100 KW ROTARY POWER TRANSFER DEVICE

S. M. Weinberger Mar. 1981 165 p refs
(Contract NAS3-22266)
(NASA-CR-165431; NAS 1.26:165431; GE-81SDS4215) Avail: NTIS HC A08/MF A01 CSCL 09C

Contactless power transfer devices for transferring electrical power across a rotating spacecraft interface were studied. A power level of 100 KW was of primary interest and the study was limited to alternating current devices. Rotary transformers and rotary capacitors together with the required dc to ac power conditioning electronics were examined. Microwave devices were addressed. The rotary transformer with resonant circuit power conditioning was selected as the most feasible approach. The rotary capacitor would be larger while microwave devices would be less efficient. A design analysis was made of a 100 KW, 20 kHz power transfer device consisting of a rotary transformer, power conditioning electronics, drive mechanism and heat rejection system. The size, weight and efficiency of the device were determined. The characteristics of a baseline slip ring were presented. Aspects of testing the 100 KW power transfer device were examined. The power transfer device is a feasible concept which can be implemented using presently available technologies. Author

N82-23396*# National Aeronautics and Space Administration. Pasadena Office, Calif.

GLASS HEATING PANELS AND METHOD FOR PREPARING THE SAME FROM ARCHITECTURAL REFLECTIVE GLASS Patent Application

Paul J. Shlichta (JPL, California Inst. of Tech., Pasadena) and Bruce A. Nerad, inventors to NASA (JPL, California Inst. of Tech., Pasadena) Filed 26 Jan. 1982 26 p
(Contract NAS7-100)
(NASA-Case-NPO-15753-1; US-Patent-Appl-SN-342871) Avail: NTIS HC A03/MF A01 CSCL 09C

A method for producing glass supported resistive heating elements is described. Electrodes are positioned in intimate contact with an outer surface of a thin electrically insulating protecting layer of architectural reflective glass. Application of a voltage of sufficient magnitude substantially destroys the insulating layer located beneath the electrodes. A subsequent application of voltage results in a passage of current through the underlying thin, light-reflective metal or metal oxide layer and in concomitant output of heat. In addition techniques are suggested for producing panels wherein the electrically heated area is readily preselected in any desired configuration. NASA

N82-23397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THREE-DIMENSIONAL RELATIVISTIC FIELD-ELECTRON INTERACTION IN A MULTICAVITY HIGH-POWER KLYSTRON. PART 2: WORKING EQUATIONS

Henry G. Kosmahl Apr. 1982 45 p refs Presented at the Intern. Electrons Devices Meeting, Washington, D.C., 11 Oct. 1971; sponsored by IEEE Also presented at the Solar Power Space System Workshop, Houston, Tex., 15-18 Jan. 1979; sponsored by NASA. Lyndon B. Johnson Space Center
(NASA-TP-2008; E-1018; NAS 1.60:2008) Avail: NTIS HC A03/MF A01 CSCL 09C

A high power multicavity klystron amplifier was designed and a computation package containing all equations and procedures needed is presented. The rigorously derived three dimensional relativistic axisymmetric equations of motion are used to compute the bunched current and the induced RF gap voltage for all interaction cavities except the input and second cavities, where the linear space charge wave theory data are employed in order to reduce the computation time. Both distance step and time step integration methods are used to compute the Fourier coefficients of both the beam current and induced current. S.L.

N82-23398# California Univ., Riverside. Dept. of Mathematics.

[THEORIES OF APPROXIMATION BY POLYNOMIALS] Final Scientific Report, 1 Jun. 1978 - 31 May 1981

LeBaron O. Ferguson Jun. 1981 5 p
(Grant AF-AFOSR-3599-78; AF Proj. 2304)
(AD-A111932; AFOSR-82-0085TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

The major goal of the grant was to see if an algorithm for finding a polynomial of best approximation with integral coefficients could be developed. This is what is actually needed in digital filter design. This report summarizes the results produced under the grant. Author (GRA)

N82-23399# Sandia Labs., Albuquerque, N. Mex. Firing Subsystems Div.

ANALYSES OF SOME PROBLEMS OCCURRING IN ELECTRON ASSEMBLY PACKAGING

Hugh R. MacDougall Oct. 1981 29 p refs
(Contract DE-AC04-76DP-00789)
(DE82-003687; SAND-81-1093) Avail: NTIS HC A03/MF A01

Five working papers on electronic assembly packaging problems discussed: analysis of stresses in electronic component leads; an estimate of temperature response in an electronic component due to a soldering operation; analysis of tress in an electronic component and solder joint due to encapsulation; effective thickness of a conformal coating on an electronic component; and uniaxial compression testing as a means of determining bulk modulus of a syntatic elastomer. Uniaxial compression testing of thin samples to determine the material bulk modulus is reviewed. Elasticity equations supply an expression for the bulk modulus in terms of the applied uniaxial stress, the observed strain, and Poisson's ratio. For special cases in which Poisson's ratio approaches 1/2, the bulk modulus is determined to be very nearly equal to the ratio of the applied stress to the observed strain. DOE

N82-23400# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Systems Technology Div.

DEVELOPMENT OF DISTRIBUTION SYSTEM RELIABILITY AND RISK ANALYSIS MODELS Final Report

J. E. D. Northcote-Green, T. D. Vismor, and C. L. Brooks Aug. 1981 39 p refs 3 Vol.
(EPRI Proj. 1356-1)
(DE82-900352; EPRI-EL-2018-Vol-1) Avail: NTIS HC A03/MF A01

The overall objectives of a research project were to: determine distribution reliability assessment methods currently used by the industry; develop a general outage reporting scheme suitable for a wide variety of distributing utilities (reliability model); develop a model for predicting the reliability of future system configurations (risk model); and compile a handbook of reliability assessment methods designed specifically for use by the practicing distribution engineer. Emphasis was placed on compiling and organizing reliability assessment techniques presently used by the industry. The project examined reliability evaluation from two perspectives:

historical and predictive assessment. Two reliability assessment models, HISRAM - the historical reliability assessment model and PRAM - the predictive reliability assessment model were developed. Each model was tested in a utility environment by the Duquesne Light Company and the Public Service Electric and Gas Company of New Jersey. A survey of 56 diverse utilities served as a basis for examining current distribution reliability assessment practices in the electric power industry. DOE

N82-23401# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Systems Technology Div.

DEVELOPMENT OF DISTRIBUTION SYSTEM RELIABILITY AND RISK ANALYSIS MODELS Final Report

T. D. Vismor, J. E. D. Northcote-Green, and R. Billinton Aug. 1981 187 p refs 2 Vol.

(EPRI Proj. 1356-1)

(DE82-900351; EPRI-EL-2018-Vol-2) Avail: NTIS HC A09/MF A01

Background material needed to determine the state-of-the-art in reliability assessment techniques used by the distribution sector of the electric power utility industry is presented. Two distinct reliability assessment methods were identified, namely historical assessment and predictive assessment. The former method typically encompasses outage reporting and analysis schemes which predominate in the industry whereas the latter technique is mainly confined to the academic arena. The organization structure within a utility and the perceived need by each function for reliability data were identified. This task was invaluable to the design of an efficient information system such as required for historical reliability assessment. A detailed literature search of predictive or probabilitistic methods revealed a wealth of well accepted theory quite sufficient on which to base a predictive assessment model for radial distribution systems. This theory is summarized with a relevant data requirements. The present use and techniques accepted within the distribution sector of the utility industry was confirmed by a survey based on the response of 56 diverse utilities. DOE

N82-23402# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Systems Technology Div.

DEVELOPMENT OF DISTRIBUTION SYSTEM RELIABILITY AND RISK ANALYSIS MODELS Final Report

T. D. Vismor, J. E. D. Northcote-Green, S. J. Kostyal, and C. L. Brooks Aug. 1981 166 p 3 Vol.

(EPRI Proj. 1356-1)

(DE82-900350; EPRI-EL-2018-Vol-3) Avail: NTIS HC A08/MF A01

The two reliability models, their testing, and the modifications of a unified distribution planning model to calculate reliability indices are described. The historical reliability assessment model HISRAM is designed to suit most utilities. Four implementation levels with different input data requirements and output capabilities permit a utility to select a level appropriate to its needs. User-defined divisions, causes and output options further add to the program flexibility. A unique feature of HISRAM is the program generation of the appropriate outage reporting form following level selection and initialization. This allows the engineer to review data input requirements before field implementation. It has the capability of estimating component failure rates and restoration times upon provision of suitable input data. The predictive reliability assessment model PRAM uses continuity criteria, together with component failure rates and restoration times to calculate load point indices. System indices similar to those produced by HISRAM are also calculated. Varying degrees of detail for representing the protection system are available through three user-selected models. Both models were tested through application. The conclusions and recommendations of the entire project are included. DOE

N82-23403# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.

OPERATION OF A FAST H. V. PROTECTION CIRCUIT FOR NEUTRAL INJECTORS WITH TWO TETRODES IN SERIES

M. Desmons, M. Fumelli, and J. Godaert Sep. 1980 26 p refs

(EUR-CEA-FC-1087) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

For the fast protection of high power, high voltage neutral beam injectors, a system consisting of two series high power tetrodes was developed. Over-voltages on one of the tubes were prevented by the use of clipping diodes. These also avoid the need of delicate circuit equilibration. The circuit, detailed tests, and model calculations are described. DOE

N82-23404# Research Inst. of National Defence, Linkoeping (Sweden).

CONSTRUCTION OF A 9.4 GHz FET AMPLIFIER [KONSTRUKTION AV FETFOERSTAERKARE FOER 9.4 GHz]

Carl-Gustaf Svensson Dec. 1981 36 p refs In SWEDISH

(FOA-C-30248-E) Avail: NTIS HC A03/MF A01

A 9.4 GHz GaAs FET amplifier was designed and built for use as a preamplifier in a prototype radar receiver. The impedance diagram for a four stage amplifier was optimized by the computer program GAIN. Impedance characteristics for minimum noise figure and high gain at each stage were calculated with S-parameter data for the Hewlett-Packard low noise HFET-2202. The transistor amplifier performance test results, for 9.4 GHz and 300 MHz bandwidth, verify computer estimations that 33 dB gain, 0.5 dB ripple, and a noise figure of 5 dB can be obtained with this four stage low noise design. Author (ESA)

N82-23405# Research Inst. of National Defence, Linkoeping (Sweden).

TRANSIENT IRRADIATION EFFECT ON 4000 SERIES CMOS CIRCUITS [TRANSIENT STRAALPAAVERKAN PAA NAAGRA CMOS-KRESTAR 1 4000-SERIEN]

Gunnar Goeransson, Per Zamuhl, and Bengt Danielsson (Saab-Scania, Goteberg) Dec. 1981 33 p In SWEDISH

(FOA-C-30250-A) Avail: NTIS HC A03/MF A01

Various CMOS devices from the 4000 series were studied as to the effects on circuit performance of exposure to an X-ray burst. The functional characteristics of the equipment were determined before irradiation, then compared with electrical measurements made on the same equipment after exposure. The radiative beam was produced by an X-ray emitter which generates 20 billion rad/sec. Total dosage was 15 rad/120 nsec, simulating an X-ray burst typical of a thermonuclear explosion. Severe damage is observed in most standard circuits. Even in 4050 model devices, protected against radiation damage, noticeable degradation is reported. Author (ESA)

N82-23406# Research Inst. of National Defence, Linkoeping (Sweden).

METHOD FOR CALCULATING CASCADE COUPLED TWO-GATE FILTERS: EXAMPLES OF UTILIZATION IN FILTERS AND ANTENNAS [METOD FOER BERAEKNING AV KASKADKOPPLADE. TVAAPORTAR MED ANVAENDNINGSEXEMPEL FRAAN FILTER-OCH ANTENNOMRAADET]

Aake Bergquist Dec. 1981 26 p refs In SWEDISH

(FOA-C-30252-E) Avail: NTIS HC A03/MF A01

A matrix method for analyzing cascade coupled resonator filters is presented. Bandpass filters were treated as an example. A simplified synthesis method for these devices is presented, which coupled with the analysis method allows for studying antennas with Chebyshev or Butterworth radiation diagrams. A synthesis of quartz transducers, using repeated analysis, is suggested. Author (ESA)

N82-23407# Research Inst. of National Defence, Linkoeping (Sweden).

MICROWAVE CIRCUIT CONSTRUCTION: INDUSTRIAL VISIT TO THE UNITED STATES IN OCTOBER 1981 [KONSTRUKTION AV MIKROVAAGSKRETSAR, STUDIERESA TILL USA 1 OKTOBER 1981]

Carl-Gustaf Svensson Dec. 1981 12 p refs In SWEDISH

(FOA-C-30258-E) Avail: NTIS HC A02/MF A01

Filter, amplifier, and oscillator devices for microwave frequencies were studied. Computer aided design of microwave circuits was stressed while students built up such circuits during laboratory training. Results relative to bandpass filters, transistor amplifiers, and active circuits are reported. Practices in circuit design analysis, synthesis and optimization are recommended. Author (ESA)

N82-23408# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

ON THE DETECTION OF MOVING OBJECTS BY SPACE AND TIME INVARIANT FILTERS

Ulrich Boes Sep. 1981 79 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-753)

(DFVLR-FB-81-37) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 17.60

A linear, three-dimensional space and time invariant filter with following threshold was designed and analyzed, by which moving objects can be detected and isolated from occlusion, background, and background noise. The structure consists of a chain of linear space and time filters which were analyzed by means of system theory. The performance was demonstrated in simulations and the detection capability proven to be superior to that of nonlinear filters based on correlation techniques. The filter is shown to be particularly useful in TV tracking devices and for controlling maintenance systems. Author (ESA)

N82-23409# Research Inst. of National Defence, Linkoeping (Sweden)..

TRANSIENT MEASUREMENTS UNDER ELECTRIC PULSE EXCITATION IN 37 VIGGEN AIRCRAFT [TRANSIENTMAETNINGAR VID STROEMPULSEXCITERING AV FPL-37 VIGGEN]

Sven Garmland Oct. 1981 54 p In SWEDISH

(FOA-C-30243-A3) Avail: NTIS HC A04/MF A01

Determinations of the magnetic field at different locations in aircraft and of the induced electromotive force in two typical communication cables of a transmission system, during full scale electric pulse tests, are reported. These measurements were carried out in relation with lightning tests, for trying out a computerized measurement system, including transient digitizers, microwave link and magnetic field cells. The pulse generator was equipped with capacitors charged up to 75 kV, developing a sine wave 30 kHz pulse current with a 100 kA max amplitude. Results enabled a computer program to be modified so as to account for actual conditions. Author (ESA)

N82-23410# Comelin, Limours (France).

INTERCONNECTIONS: STUDY OF RESISTANCE IN INSULATION OF FLEXIBLE AND SEMIRIGID CIRCUITS [ETUDE DES RESISTANCES D'ISOLEMENT SUR CIRCUITS SOUPLES ET FLEX-RIGIDES]

G. Guillerm 5 Nov. 1981 87 p refs In FRENCH

Avail: NTIS HC A05/MF A01

The influence of different parameters that define the electrical resistance of insulating materials between conductors was studied in order to deduce laws which can be used in designing interconnecting systems, e.g. MAGIC or STACP. Test specimens of insulation were obtained from several manufacturers and electrical measurements conditions were parameterized. Problems relative to measuring high resistance were identified. A three-step procedural scheme for quality control of insulation is presented, i.e. (1) prediction of insulation resistance before fabrication, (2) verification during fabrication, and (3) inspection after fabrication. Author (ESA)

N82-23411# National Bureau of Standards, Washington, D.C. Center for Electronics and Electrical Engineering.

MEASUREMENT TECHNIQUES FOR HIGH POWER SEMICONDUCTOR MATERIALS AND DEVICES Annual Report, 1 Oct. 1979 - 30 Sep. 1980

R. C, Larrabee, W. E. Phillips, and W. R. Thurber Sep. 1981 53 p refs

(Contract DOE-EA-77-A-01-6010)

(PB82-117706; NBSIR-81-2325) Avail: NTIS HC A04/MF A01 CSCL 09A

Measurement techniques to detect, characterize, and identify deep level impurities in semiconductors are required in order to monitor the presence of unintentional contamination or to characterize and understand the behavior of intentionally added impurities. Specific impurities were introduced into silicon wafers and the resulting deep levels characterized. The results of these deep-level characterization techniques were correlated with the electrical properties of devices. Preferred procedures for specimen preparation for spreading resistance measurements on thyristor grade silicon were standardized. GRA

N82-23412# National Bureau of Standards, Washington, D.C. Thermophysical Properties Div.

HELIUM RESEARCH IN SUPPORT OF SUPERCONDUCTING POWER TRANSMISSION Annual Report, 1 Oct. 1979 - 1 Sep. 1980

D. E. Daney, ed. Sep. 1981 45 p refs Sponsored in part by Brookhaven National Lab.

(PB82-122987; NBSIR-81-1649) Avail: NTIS HC A03/MF A01 CSCL 09C

In developing superconducting power transmission line cooldown strategies a computer code was used to explore cooldown times for a wide variety of realistic boundary conditions. Cooldown times of 10 days are feasible with only minor modification to previously proposed refrigeration systems if cooling channel lengths are reduced to two thirds or one half those dictated by steady state considerations. Evaluation of thermal flux meters was concluded. Below ground field tests revealed large effects due to seasonal variation in the soil heat flux. These effects are largely cancelled by algebraic addition of the signals from a pair of horizontally opposed sensors. A brief above ground field evaluation indicated that diurnal variations in the heat flux completely mask heat fluxes typical of the anticipated enclosure heat flux. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N82-23413# Delaware Univ., Newark.

LAMINAR AND TURBULENT NATURAL CONVECTION HEAT TRANSFER FROM HORIZONTAL CYLINDERS Ph.D. Thesis

Bakhtier Farouk 1981 241 p

Avail: Univ. Microfilms Order No. 8128347

Laminar and turbulent natural convection flows induced by horizontal cylinders were investigated numerically. A finite difference scheme based on the integration of the governing equations over finite cell was applied to the two dimensional steady-state (time averaged) problems. Laminar and turbulent flow predictions were obtained for natural convection around a horizontal cylinder with uniform and nonuniform wall boundary conditions and in concentric annulus where circulation is prominent. A two equation (k-epsilon) turbulence model was extended to include the effects of buoyancy and applied for predicting time averaged flow patterns, temperatures, turbulence intensity and turbulent viscosity in recirculating natural convection flows. Dissert. Abstr.

N82-23414# California Univ., Berkeley.

THE EVOLUTION OF STREAMWISE VORTICITY IN THE FREE SHEAR LAYER Ph.D. Thesis

Shyi-Jang Lin 1981 131 p

Avail: Univ. Microfilms Order No. 8200186

Three dimensional motion in a free shear layer is considered. It is postulated that streamwise vorticity appears as the result of an initial instability of the layer. A number of simplified models are used to describe vortex evolution when it is subjected to the dominant influence of the time-dependent two dimensional flow. The linear and nonlinear behavior of vortices subjected to an axial strain is examined. The role which these vortices play in enhancing molecular mixing is also explored. For sufficiently high Reynolds numbers, it is found that such vortices are unstable in shear and are transformed into smaller vortices. The nonlinear evolution of these vortices tend to increase their vorticity and to decrease the space they occupy. It is characteristic of the motions studied that they all result in isolated vortices and the field of strain which they create between them produces thin

elongated transport layers which expels the vorticity component parallel to the axis of these vortices. Dissert. Abstr.

N82-23415# Arizona Univ., Tucson.
ANALYSIS OF TWO-DIMENSIONAL VISCOUS FLOW OVER AN ELLIPTIC BODY IN UNSTEADY MOTION Ph.D. Thesis
Mohammad Esmaail Taslim 1981 251 p
Avail: Univ. Microfilms Order No. 8129347

The two dimensional viscous flow around an elliptic cylinder undergoing prescribed unsteady motions is analyzed. The fluid is taken to be incompressible. The Biot-Savart law of induced velocities is utilized to account fo the contribution to the velocity field of the different vorticity fields comprising the flow. The bound vorticity on the body surface is in the form of a vortex sheet, and its distribution is governed by a Fredholm integral equation of the second kind. The equation is derived in detail and solved numerically. The motion of the free vorticity in the flow field is governed by the Navier-Stokes equations written in terms of vorticity. The results obtained using the present method are compared with a number of special cases available in the literature. Viscous flows around a circular cylinder rotating in any arbitrary fashion and around elliptic cylinders of different aspect ratios rotating with a constant angular velocity, or undergoing a combined translation and pitching ocillation were investigated. Dissert. Abstr.

N82-23416# Minnesota Univ., Minneapolis.
ANALYSIS AND PREDICTION OF HEATED SURFACE JETS Ph.D. Thesis
Cawniambakkam Totadri Shanmugham 1981 230 p
Avail: Univ. Microfilms Order No. 8126021

An integral model for predicting the temperature distribution in the near field of a heated surface discharge is presented. The model uses a numerical solution of the steady flow continuity, momentum, and heat transport equations. A normal error distribution function was taken as the similarity function was taken as the similarity function to represent the velocity and temperature distributions in the plume section. Contributions of momentum exchange and buoyancy to lateral spreading of surface plumes are accounted for by considering the unbalanced pressure due to the density difference between the plume and the ambient and the turbulent shear in the section as elements in the transverse momentum equation. The shear is taken as a function of the velocity distribution in the section independent of the degree of buoyancy. The self-preserving nature of the velocity and temperature distributions is littled affected when half sections are considered on either side of the vertical through the point of maximum velocity at the surface. The spreading rates for the two parts is derived separately from the transverse momentum equation. The zone of flow establishment near an outlet is modeled empirically. Dissert. Abstr.

N82-23417*# Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
LASER DOPPLER MEASUREMENTS OF LAMINAR AND TURBULENT FLOW IN A PIPE BEND Final Report
M. M. Enayet, M. M. Gibson, A. M. K. P. Taylor, and M. Yianneskis May 1982 62 p refs
(Contract NASw-3258)
(NASA-CR-3551; NAS 1.26:3551; FS/81/19) Avail: NTIS HC A04/MF A01 CSCL 20D

The streamwise components of velocity in the flow through a ninety degree bend of circular cross section for which the ratio of radius of curvature to diameter is 2.8 were measured. The development of strong pressure driven secondary flow in the form of a pair of counter rotating vortices in the steamwise direction is shown. Refractive index matching at the fluid wall interface was not employed; the displacement of the measurement volume due to refraction is allowed for in simple geometrical calculations. S.L.

N82-23418*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE SECOND INTERNATIONAL COLLOQUIUM ON DROPS AND BUBBLES
Dennis H. LeCroissette, ed. 1 Mar. 1982 400 p refs Colloq. held in Monterey, Calif., 19-21 Nov. 1981
(Contract NAS7-100)
(NASA-CR-168848; JPL-Pub-82-7; NAS 1.26:168848) Avail: NTIS HC A17/MF A01 CSCL 20D

Applications of bubble and drop technologies are discussed and include: low gravity manufacturing, containerless melts, microballoon fabrication, ink printers, laser fusion targets, generation of organic glass and metal shells, and space processing. The fluid dynamics of bubbles and drops were examined. Thermomigration, capillary flow, and interfacial tension are discussed. Techniques for drop control are presented and include drop size control and drop shape control. For individual titles, see N82-23419 through N82-23469.

N82-23419*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
DROPS AND BUBBLE IN MATERIALS SCIENCE
Robert H. Doremus *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 1-6 refs (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The formation of extended p-n junctions in semiconductors by drop migration, mechanisms and morphologies of migrating drops and bubbles in solids and nucleation and corrections to the Volmer-Weber equations are discussed. Bubble shrinkage in the processing of glass, the formation of glass microshells as laser-fusion targets, and radiation-induced voids in nuclear reactors were examined. T.M.

N82-23420*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NORMAL MODES OF A COMPOUND DROP
M. Saffren, D. D. Elleman, and W. K. Rhim *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 7-14 refs (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The modes are characterized by their frequency, the attendant displacement of fluid boundaries, and the flow pressure fields within the fluids. The drops consist of three fluids; a core fluid, a fluid shell surrounding the core, and a host fluid surrounding the shell. These fluids are assumed to be inviscid and incompressible, and the core and the shell to be concentric. The theory is obtained by linearization of the equations of fluid motion to the lowest order of nonlinearity that yields the normal modes. Numerical values of mode frequencies and the associated relative displacements of the fluid boundaries are presented for several specific systems, and the results compared with observations. T.M.

N82-23421*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Chemical Engineering.
INTERACTION EFFECTS IN THERMOCAPILLARY BUBBLE MIGRATION
M. Meyyappan, William R. Wilcox, and R. Shankar Subramanian *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 15-16 refs Sponsored in part by Westinghouse Research and Development Center (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Two bubbles migrating along their line of centers under the influence of an imposed thermal gradient are considered in the quasi-static limit. Results are reported for representative values of the governing parameters. Author

N82-23422*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
DIELECTROPHORETIC LEVITATION OF DROPLETS AND BUBBLES
T. B. Jones *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 17-25 refs Sponsored in part by NBS and Lawrence Livermore Lab. (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Uncharged droplets and bubbles can be levitated dielectrophoretically in liquids using strong, nonuniform electric fields. The general equations of motion for a droplet or bubble in an axisymmetric, divergence-free electrostatic field allow determination of the conditions necessary and sufficient for stable levitation. The design of dielectrophoretic (DEP) levitation electrode structures is simplified by a Taylor-series expansion of cusped

axisymmetric electrostatic fields. Extensive experimental measurements on bubbles in insulating liquids verify the simple dielectrophoretic model. Other have extended dielectrophoretic levitation to very small particles in aqueous media. Applications of DEP levitation to the study of gas bubbles, liquid droplets, and solid particles are discussed. Some of these applications are of special interest in the reduced gravitational field of a spacecraft. T.M.

N82-23423*# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Chemical Engineering.

THE MOTION OF BUBBLES INSIDE DROPS IN CONTAINERLESS PROCESSING

N. Shankar, P. Annamalai, Robert Cole, and R. Shankar Subramanian *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 26-30 refs (For primary document see N82-23418 14-34)

(Contract NAS8-32944)

Avail: NTIS HC A17/MF A01 CSCL 20D

A theoretical model of thermocapillary bubble motion inside a drop, located in a space laboratory, due to an arbitrary axisymmetric temperature distribution on the drop surface was constructed. Typical results for the stream function and temperature fields as well as the migration velocity of the bubble were obtained in the quasistatic limit. The motion of bubbles in a rotating body of liquid was studied experimentally, and an approximate theoretical model was developed. Comparison of the experimental observations of the bubble trajectories and centering times with theoretical predictions lends qualified support to the theory. Author

N82-23424*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ACOUSTICALLY INDUCED OSCILLATION AND ROTATION OF A LARGE DROP IN SPACE

Nathan Jacobi, Arvid P. Croonquist, Daniel D. Elleman, and Taylor G. Wang *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 31-38 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A 2.5 cm diameter water drop was successfully deployed and manipulated in a triaxial acoustic resonance chamber during a 240 sec low-gravity SPAR rocket flight. Oscillation and rotation were induced by modulating and phase shifting the signals to the speakers. Portions of the film record were digitized and analyzed. Spectral analysis brought out the n = 2, 3, 4 free oscillation modes of the drop, its very low-frequency center-of-mass motion in the acoustic potential well, and the forced oscillation frequency. The drop boundaries were least-square fitted to general ellipses, providing eccentricities of the distorted drop. The normalized equatorial area of the rotating drop was plotted vs a rotational parameter, and was in excellent agreement with values derived from the theory of equilibrium shapes of rotating liquid drops. Author

N82-23425*# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.

MECHANISMS OF DROPLET COMBUSTION

C. K. Law *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 39-53 refs Sponsored by DOE and NSF (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The fundamental physico-chemical mechanisms governing droplet vaporization and combustion are discussed. Specific topics include governing equations and simplifications, the classical d(2)-Law solution and its subsequent modification, finite-rate kinetics and the flame structure, droplet dynamics, near- and super-critical combustion, combustion of multicomponent fuel blends/emulsions/suspensions, and droplet interaction. Potential research topics are suggested. Author

N82-23426*# International Business Machines Corp., San Jose, Calif.

A NUMERICAL STUDY OF DROP-ON-DEMAND INK JETS

J. Fromm *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 54-62 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Ongoing work related to development and utilization of a numerical model for treating the fluid dynamics of ink jets is discussed. The model embodies the complete nonlinear, time dependent, axi-symmetric equations in finite difference form. The jet nozzle geometry with no-slip boundary conditions and the existence of a contact circle are included. The contact circle is allowed some freedom of movement, but wetting of exterior surfaces is not addressed. The principal objective in current numerical experiments is to determine what pressure history, in conjunction with surface forces, will lead to clean drop formation. T.M.

N82-23427*# Illinois Univ., Urbana. Dept. of Electrical Engineering.

ELECTROHYDRODYNAMIC (EHD) STIMULATION OF JET BREAKUP

Joseph M. Crowley *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 63-70 refs Prepared in cooperation with Xerox Corp., Rochester, N.Y. (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Electrohydrodynamic (EHD) excitation of liquid jets offers an alternative to piezoelectric excitation without the complex frequency response caused by piezoelectric and mechanical resonances. In an EHD exciter, an electrode near the nozzle applies an alternating Coulomb force to the jet surface, generating a disturbance which grows until a drop breaks off downstream. This interaction is modelled quite well by a linear, long wave model of the jet together with a cylindrical electric field. The breakup length, measured on a 33 micrometer jet, agrees quite well with that predicted by the theory, and increases with the square of the applied voltage, as expected. In addition, the frequency response is very smooth, with pronounced nulls occurring only at frequencies related to the time which the jet spends inside the exciter. Author

N82-23428*# Technical Univ. of Istanbul (Turkey).

THE STRESS SYSTEM GENERATED BY AN ELECTROMAGNETIC FIELD IN A SUSPENSION OF DROPS

M. Emin Erdogan *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 71-78 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The stress generated in a suspension of drops in the presence of a uniform electric field and a pure straining motion, taking into account that the magnetohydrodynamic effects are dominant was calculated. It was found that the stress generated in the suspension depended on the direction of the applied electric field, the dielectric constants, the vicosity coefficients, the conductivities, and the permeabilities of fluids inside and outside the drops. The expression of the particle stress shows that for fluids which are good conductors and poor dielectrics, especially for larger drops, magnetohydrodynamic effects end to reduce the dependence on the direction of the applied electric field. Author

N82-23429*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HYDRODYNAMIC PERFORMANCE OF AN ANNULAR LIQUID JET: PRODUCTION OF SPHERICAL SHELLS

James M. Kendall *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 79-87 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

An annular jet flow of liquid surrounding a flow of gas at its core is extremely unstable. Axisymmetric oscillations arise spontaneously, and grow with such rapidity along the axial dimension that a pinch-off of the liquid and an encapsulation of the core gas occurs within as few as four jet diameters. The shells which result thereby may be described as thick-wall bubbles, for which van der Waals forces are unimportant. A description is given of the fluid dynamic processes by which the shells are formed, and of means for preserving and promoting the geometrical of the product. The forming of metallic shells is mentioned. Author

N82-23430*# California Univ., Livermore. Lawrence Livermore Lab.

INERTIAL CONFINEMENT FUSION TARGETS

Charles D. Hendricks *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 88-93 (For primary document see N82-23418 14-34)
(Contract W-7405-eng-48)
Avail: NTIS HC A17/MF A01 CSCL 20D

Inertial confinement fusion (ICF) targets are made as simple flat discs, as hollow shells or as complicated multilayer structures. Many techniques were devised for producing the targets. Glass and metal shells are made by using drop and bubble techniques. Solid hydrogen shells are also produced by adapting old methods to the solution of modern problems. Some of these techniques, problems, and solutions are discussed. In addition, the applications of many of the techniques to fabrication of ICF targets is presented. Author

N82-23431*# Illinois Univ., Urbana. Dept. of Electrical Engineering.
BEHAVIOR OF LIQUID HYDROGEN INSIDE AN ICF TARGET
K. Kim, L. Mok, and T. Bernat *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 96-106 refs Sponsored by DOE Prepared in cooperation with California Univ., Lawrence Livermore Lab. (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

The configuration of liquid hydrogen inside spherical glass shell ICF target was studied both theoretically and experimentally. Because of the zero contact angle between the .D2 liquid and glass substrate and the limited wetting surface that is continuous, the liquid hydrogen completely covers the interior of the glass shell, resulting in the formation of a void at the center. For this reason, the present problem distinguishes itself from that for a sessile drop sitting on a flat surface. A theory was formulated to calculate the liquid hydrogen configuration by including the London-dispersion force between the liquid and the substrate molecules. The net result is an augmented Bashforth-Adams equation appropriate to a spherical substrate, which is considered to be the major contribution of the present work. Preliminary calculations indicate that this equation accurately models the liquid hydrogen behavior inside a spherical microshell. Author

N82-23432*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GENERATION OF A STRONG CORE CENTERING FORCE IN A SUBMILLIMETER COMPOUND DROPLET SYSTEM
Mark C. Lee, I-an Feng, Daniel D. Elleman, Taylor G. Wang, and Ainslie T. Young (LASL) *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 107-111 refs (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

By amplitude-modulating the driving voltage of an acoustic levitating apparatus, a strong core centering force was generated in a submillimeter compound droplet system suspended by the radiation pressure in a gaseous medium. Depending on the acoustic characteristics of the droplet system, it was found that the technique can be utilized advantageously in the multiple-layer coating of an inertial confinement fusion pellet. Author

N82-23433*# Sandia Labs., Albuquerque, N. Mex.
HOLOGRAPHIC STUDIES OF THE VAPOR EXPLOSION OF VAPORIZING WATER-IN-FUEL EMULSION DROPLETS
Stephen A. Sheffield, C. F. Hess (Spectron Development Labs., Inc., Costa Mesa, Calif.), and J. D. Trolinger (Spectron Development Labs., Inc., Costa Mesa, Calif.) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 112-119 refs (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Holographic studies were performed which examined the fragmentation process during vapor explosion of a water-in-fuel (hexadecane/water) emulsion droplet. Holograms were taken at 700 to 1000 microseconds after the vapor explosion. Photographs of the reconstructed holograms reveal a wide range of fragment droplet sizes created during the explosion process. Fragment droplet diameters range from below 10 microns to over 100 microns. It is estimated that between ten thousand and a million fragment droplets can result from this extremely violent vapor explosion process. This enhanced atomization is thus expected to have a pronounced effect on vaporization processes which are present during combustion of emulsified fuels. Author

N82-23434*# University of Western Ontario, London. Faculty of Engineering Science.
DROPLETS GENERATED FROM A NEW OGEE SHAPED, LIQUID, AIR-SHEAR, ELECTROSTATIC NOZZLE
I. I. Inculet, T. E. Base, and G. S. P. Castle *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 120-123 refs Sponsored by National Science and Engineering Research Council of Canada (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

A series of experimental tests was carried out on an 'OGEE' shaped planform, liquid air-shear electrostatic nozzle. Liquid was ejected from the upper surface of the nozzle and was then dispersed and atomized efficiently by a high speed air flow passing over the nozzle and by the effect of two very strong coherent air vortices generated by the 'OGEE' shaped nozzle surface. Initial test results which are presented show the nozzle to perform far superior to a similar delta wing shaped design which is used extensively in various industries applications. Author

N82-23435*# California Univ., Livermore. Lawrence Livermore Lab.
LIQUID DROP TECHNIQUE FOR GENERATION OF ORGANIC GLASS AND METAL SHELLS
C. D. Hendricks *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 124-128 refs Sponsored by DOE (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

It was found that liquid drop techniques are very useful in several diverse areas. For producing very uniform metallic, organic, inorganic and, on particular, glassy shells, the liquid jet method is the most reproducible and exceptionally useful of all the techniques studied. The technique of capillary wave synchronization of the break-up of single and multiple component jets was utilized to produce uniform sized liquid drops and solid particles, and hollow liquid and solid shells. The technique was also used to encapsulate a number of liquids in impermeable spherical shells. Highly uniform glass shells were made by generating uniform drops of glass forming materials in an aqueous solution, subsequently evaporating the water, and then fusing and blowing the remaining solids in a high temperature vertical tube furnace. Experimental results are presented and the critical problems in further research in this field are discussed. Author

N82-23436*# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
SURFACE TENSION AND CONTACT ANGLES: MOLECULAR ORIGINS AND ASSOCIATED MICROSTRUCTURE
H. T. Davis *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 129-142 refs Sponsored by DOE (For primary document see N82-23418 14-34)
Avail: NTIS HC A17/MF A01 CSCL 20D

Gradient theory converts the molecular theory of inhomogeneous fluid into nonlinear boundary value problems for density and stress distributions in fluid interfaces, contact line regions, nuclei and microdroplets, and other fluid microstructures. The relationship between the basic patterns of fluid phase behavior and the occurrence and stability of fluid microstructures was clearly established by the theory. All the inputs of the theory have molecular expressions which are computable from simple models. On another level, the theory becomes a phenomenological framework in which the equation of state of homogeneous fluid and sets of influence parameters of inhomogeneous fluids are the inputs and the structures, stress tensions and contact angles of menisci are the outputs. These outputs, which find applications in the science and technology of drops and bubbles, are discussed. Author

N82-23437*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LARGE AMPLITUDE DROP SHAPE OSCILLATIONS
E. H. Trinh and T. G. Wang *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 143-150 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

An experimental study of large amplitude drop shape oscillation was conducted in immiscible liquids systems and with levitated free liquid drops in air. In liquid-liquid systems the results indicate the existence of familiar characteristics of nonlinear phenomena. The resonance frequency of the fundamental quadrupole mode of stationary, low viscosity Silicone oil drops acoustically levitated in water falls to noticeably low values as the amplitude of oscillation is increased. A typical, experimentally determined relative frequency decrease of a 0.5 cubic centimeters drop would be about 10% when the maximum deformed shape is characterized by a major to minor axial ratio of 1.9. On the other hand, no change in the fundamental mode frequency could be detected for 1 mm drops levitated in air. The experimental data for the decay constant of the quadrupole mode of drops immersed in a liquid host indicate a slight increase for larger oscillation amplitudes. A qualitative investigation of the internal fluid flows for such drops revealed the existence of steady internal circulation within drops oscillating in the fundamental and higher modes. The flow field configuration in the outer host liquid is also significantly altered when the drop oscillation amplitude becomes large. M.D.K.

N82-23438*# California Inst. of Tech., Pasadena. Dept. of Chemical Engineering.

BUBBLE SHAPES IN STEADY AXISYMMETRIC FLOWS AT INTERMEDIATE REYNOLDS NUMBER

G. Ryskin and L. G. Leal *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 151-156 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The shape of a gas bubble which rises through a quiescent incompressible, Newtonian fluid at intermediate Reynolds numbers is considered. Exact numerical solutions for the velocity and pressure fields, as well as the bubble shape, are obtained using finite difference techniques and a numerically generated transformation to an orthogonal, boundary-fitted coordinate system. No restriction is placed on the allowable magnitude of deformation. Author

N82-23439*# Paris VI Univ. (France).

THE PRODUCTION OF DROPS BY THE BURSTING OF A BUBBLE AT AN AIR LIQUID INTERFACE

J. S. Darrozes and P. Ligneul *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 157-165 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The fundamental mechanism arising during the bursting of a bubble at an air-liquid interface is described. A single bubble was followed from an arbitrary depth in the liquid, up to the creation and motion of the film and jet drops. Several phenomena were involved and their relative order of magnitude was compared in order to point out the dimensionless parameters which govern each step of the motion. High-speed cinematography is employed. The characteristic bubble radius which separates the creation of jet drops from cap bursting without jet drops is expressed mathematically. The corresponding numerical value for water is 3 mm and agrees with experimental observations. Author

N82-23440*# Washington State Univ., Pullman. Dept. of Physics.

RESONANCES, RADIATION PRESSURE AND OPTICAL SCATTERING PHENOMENA OF DROPS AND BUBBLES

P. L. Marston, S. G. Goosby, D. S. Langley, and S. E. LoPorto-Arione *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 166-174 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Acoustic levitation and the response of fluid spheres to spherical harmonic projections of the radiation pressure are described. Simplified discussions of the projections are given. A relationship between the tangential radiation stress and the Konstantinov effect is introduced and fundamental streaming patterns for drops are predicted. Experiments on the forced shape oscillation of drops are described and photographs of drop fission are displayed. Photographs of critical angle and glory scattering by bubbles and rainbow scattering by drops are displayed. Author

N82-23441*# Pavia Univ. (Italy). Inst. di Matematica.

A NUMERICAL METHOD FOR THE DYNAMICS OF NON-SPHERICAL CAVITATION BUBBLES

G. Lucca and A. Prosperetti *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 175-181 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A boundary integral numerical method for the dynamics of nonspherical cavitation bubbles in inviscid incompressible liquids is described. Only surface values of the velocity potential and its first derivatives are involved. The problem of solving the Laplace equation in the entire domain occupied by the liquid is thus avoided. The collapse of a bubble in the vicinity of a solid wall and the collapse of three bubbles with collinear centers are considered. Author

N82-23442*# Toulon Univ., La Garde (France).

SIZE DISTRIBUTION OF OCEANIC AIR BUBBLES ENTRAINED IN SEA-WATER BY WAVE-BREAKING

Francois Resch and Francois Avellan (Ecole Polytechnique Federale de Lauzanne) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 182-186 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The size of oceanic air bubbles produced by whitecaps and wave-breaking is determined. The production of liquid aerosols at the sea surface is predicted. These liquid aerosols are at the origin of most of the particulate materials exchanged between the ocean and the atmosphere. A prototype was designed and built using an optical technique based on the principle of light scattering at an angle of ninety degrees from the incident light beam. The output voltage is a direct function of the bubble diameter. Calibration of the probe was carried out within a range of 300 microns to 1.2 mm. Bubbles produced by wave-breaking in a large air-sea interaction simulating facility. Experimental results are given in the form of size spectrum. Author

N82-23443*# Martin Marietta Aerospace, Denver, Colo. Propulsion Section.

COLLAPSE OF LARGE VAPOR BUBBLES

James Tegart and Sam Dominick *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 187-194 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The refilling of propellant tanks while in a low-gravity environment requires that entrapped vapor bubbles be collapsed by increasing the system pressure. Tests were performed to verify the mechanism of collapse for these large vapor bubbles with the thermodynamic conditions, geometry, and boundary conditions being those applicable to propellant storage systems. For these conditions it was found that conduction heat transfer determined the collapse rate, with the specific bubble geometry having a significant influence. Author

N82-23444*# National Aeronautical Establishment, Ottawa (Ontario).

A NEW DROPLET GENERATOR

W. E. Slack *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 195-202 (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A new droplet generator is described. A loud speaker driven extractor needle was immersed in a pendant drop. Pulsing the speaker extracted the needle forming a fluid ligament which will decay into a droplet. The droplets were sized by stroboscopic photographs. The droplet's size was changed by varying the amplitude of the speaker pulses and the extractor needle diameter. The mechanism of droplet formation is discussed and photographs of ligament decay are presented. The droplet generator worked well on both oil and water based pesticide formulations. Current applications and results are discussed. Author

N82-23445*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NON-AXISYMMETRIC SHAPES OF A ROTATING DROP IN

AN IMMISCIBLE SYSTEM

T. G. Wang, R. Tagg, L. Cammack, and A. P. Croonquist *In its* Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 203-213 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The nonaxisymmetric shapes of a rotating drop in an immiscible system were studied. Five basic families of shapes (axisymmetric, two-lobed, three-lobed, four-lobed, and toroidal) were observed. The sequence (axisymmetric to two-lobed to three-lobed to four-lobed to toroidal) seems to be linked to increasing spin-up velocity. For the axisymmetric case, direct comparisons of experiments with the theory of a free rotating drop were surprisingly good the equatorial area differs from theory by only 30%. Furthermore, the non-axisymmetric shapes are in good qualitative agreement with the theory, although the theory does not address the presence of an outer fluid. Author

N82-23446*# California Univ., Berkeley. Dept. of Astronomy.

FRAGMENTATION OF INTERSTELLAR CLOUDS AND STAR FORMATION

Joseph Silk *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 214-221 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The principal issues are addressed: the fragmentation of molecular clouds into units of stellar mass and the impact of star formation on molecular clouds. The observational evidence for fragmentation is summarized, and the gravitational instability described of a uniform spherical cloud collapsing from rest. The implications are considered of a finite pressure for the minimum fragment mass that is attainable in opacity-limited fragmentation. The role of magnetic fields is discussed in resolving the angular momentum problem and in making the collapse anisotropic, with notable consequences for fragmentation theory. Interactions between fragments are described, with emphasis on the effect of protostellar winds on the ambient cloud matter and on inhibiting further star formation. Such interactions are likely to have profound consequences for regulating the rate of star formation and on the energetics and dynamics of molecular clouds. Author

N82-23447*# Observatoire de Nice (France).

SOLIDIFICATION OF CARBON-OXYGEN WHITE DWARFS

E. Schatzman *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 222-226 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The internal structure of white dwarfs is discussed. Highly correlated plasmas are reviewed. Implications for phase separation in the core of cooling white dwarfs are considered. The consequences for evolution of white dwarfs are addressed. N.W.

N82-23448*# Manchester Univ. (England). Dept. of Physics.

DROP PROCESSES IN NATURAL CLOUDS

J. Latham *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 227-238 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A model of the diffusive mixing of dry and cloudy air, a process considered to be fundamental to the development of natural clouds, is presented. Water drops are formed at the cloud base by condensation upon nuclei and as they rise they grow by vapor diffusion in the slightly supersaturated environment of the clouds. Turbulent mixing between cloudy air and undersaturated air entrained from outside produces fluctuations in supersaturation, not linked to changes in vertical velocity, which cause broadening of the condensate spectrum and the rapid production of droplets large enough to engage in growth by coalescence. The probabilities of permanent union or the production of satellite droplets following the collision of a pair of raindrops is a sensitive function of several parameters. In some circumstances electrohydrodynamic bursting may influence the properties of clouds. J.D.

N82-23449*# California Univ., Los Angeles. Dept. of Atmospheric Sciences.

A WIND TUNNEL INVESTIGATION OF THE SHAPE OF UNCHARGED RAINDROPS IN THE PRESENCE OF AN EXTERNAL, ELECTRIC FIELD

H. R. Pruppacher, R. Rasmussen, C. Walcek, and P. K. Wang (Wisconsin Univ., Madison) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 239-243 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Results of a wind tunnel experiment in which electrically uncharged water drops of 500 to 3000 microns equivalent radius are freely suspended in the vertical air stream of the UCLA cloud tunnel are presented. During this suspension the drops were exposed to external vertical electric fields of 500 to 8,000 volts/cm. The change in drop shape with drop size and electric field strength was noted and is discussed in the light of theoretical work cited in the literature which unfortunately does not take into account the effects of air flow past the drop. The wind tunnel study is documented by stills from a 16 mm film record that demonstrates the shape of water drops in response to both hydrodynamic and electric forces. Author

N82-23450*# Illinois Univ., Urbana. Dept. of Atmospheric Sciences.

RAINDROP OSCILLATIONS

K. V. Beard *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 244-246 refs Sponsored in cooperation with the Illinois State Water Survey, Urbana (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A model of the change in shape of a raindrop is presented. Raindrops measured by two orthogonal cameras were classified by shape and orientation to determine the nature of the oscillation. A physical model based on potential energy was then developed to study the amplitude variation of oscillating drops. The model results show that oscillations occur about the equilibrium axis ratio, but the time average axis ratio if significantly more spherical for large amplitudes because of asymmetry in the surface potential energy. A generalization of the model to oscillations produced by turbulence yields average axis ratios that are consistent with the camera measurements. The model results for average axis ratios were applied to rainfall studies with a dual polarized radar. J.D.

N82-23451*# Illinois State Water Survey, Urbana. Meteorology Section.

DROP REBOUND IN CLOUDS AND PRECIPITATION

Harry T. Ochs, III and K. V. Beard *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 247-254 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The possibility of rebound for colliding cloud drops was measured by determining the collection efficiency. The collection efficiency for 17 size pairs of relatively uncharged drops in over 500 experimental runs was measured using two techniques. The collection efficiencies fall in a narrow range of 0.60 to 0.70 even though the collection drop was varied between 63 and 326 microns and the size ratio from 0.05 to 0.33. In addition the measured values of collection efficiencies (Epsilon) were below the computed values of collision efficiencies (E) for rigid spheres. Therefore it was concluded that rebound was occurring for these sizes since inferred coalescence (epsilon = Epsilon/E) efficiencies are about 0.6 yo 0.8. At a very small size ratio ($r/R = p = 0.05$, $R = 326$ microns) the coalescence efficiency inferred is in good agreement with the experimental findings for a supported collector drop. At somewhat large size ratios the inferred values of epsilon are well above results of supported drop experiments, but show a slight correspondence in collected drop size dependency to two models of drop rebound. At a large size ratio ($p = 0.73$, $R = 275$) the inferred coalescence efficiency is significantly different from all previous results. J.D.

N82-23452*# State Univ. of New York at Albany. Atmospheric Sciences Research Center.

THE GEOPHYSICAL IMPORTANCE OF BUBBLES IN THE SEA

Ramon J. Cirpriano *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 255-259 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Present knowledge of the mechanisms for production and enrichment and film drops by bursting bubbles is summarized,

with particular emphasis on the unsolved problems. Sea salt is by far the major constituent cycled through the Earth's atmosphere each year. Bursting bubbles in the oceans appear to be primarily responsible. These salt particles play a role in the formation of maritime clouds, which in turn affect the Earth's radiation budget. Along with the salt are carried various chemical pollutants and potentially pathogenic microorganisms, often in highly enriched form. J.D.

N82-23453*# Los Alamos Scientific Lab., N. Mex. Theoretical Div.

FLUID DYNAMICAL DESCRIPTION OF RELATIVISTIC NUCLEAR COLLISIONS

J. R. Nix and D. Strottman *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 260-267 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

On the basis of both a conventional relativistic nuclear fluid dynamic model and a two fluid generalization that takes into account the interpenetration of the target and projectile upon contact, collisions between heavy nuclei moving at relativistic speeds are calculated. This is done by solving the relevant equations of motion numerically in three spatial dimensions by use of particle in cell finite difference computing techniques. The effect of incorporating a density isomer, or quasistable state, in the nuclear equation of state at three times normal nuclear density, and the effect of doubling the nuclear compressibility coefficient are studied. For the reaction 20Ne + 238U at a laboratory bombarding energy per nucleon of 393 MeV, the calculated distributions in energy and angle of outgoing charged particles are compared with recent experimental data both integrated over all impact parameters and for nearly central collisions. Author

N82-23454*# California Univ., Livermore. Lawrence Livermore Lab.

STUDIES OF THE NUCLER EQUATION OF STATE USING NUMERICAL CALCULATIONS OF NUCLEAR DROP COLLISIONS

C. T. Alonso, J. M. LeBlanc, and J. R. Wilson *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 268-279 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A numerical calculation for the full thermal dynamics of colliding nuclei was developed. Preliminary results are reported for the thermal fluid dynamics in such processes as Coulomb scattering, fusion, fusion-fission, bulk oscillations, compression with heating, and collisions of heated nuclei. Author

N82-23455*# Stanford Univ., Calif. Dept. of Chemistry.

THE SIZE AND SHAPE OF EQUILIBRIUM CAPILLARY SURFACES

Robert Finn *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 280-285 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The classical theory of capillary is concerned largely with size and shape estimates in symmetric asymptotic configurations. Recent developments leading to global results for all symmetric cases, and to qualitative information on asymptotic properties are discussed. Additional stability criteria are described. Asymmetric situations leading to behavior that differs strikingly from the symmetric case are discussed. When gravity vanishes, capillary surfaces in the accustomed sense may not appear. The question of characterizing those tubes in which surfaces can be found has partially been settled. Progress toward determining the effects of contact angle hysteresis in cases of particular interest is reported. J.D.

N82-23456*# Toledo Univ., Ohio. Dept. of Mathematics.

THE STABILITY OF THE AXIALLY SYMMETRIC PENDENT DROP

Henry C. Wente *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 286-294 refs (For primary document see N82-23418 14-34)

(Grant NSF MPS-75-07402)

Avail: NTIS HC A17/MF A01 CSCL 20D

The axially symmetric pendent drop as it occurs in three different physical settings is analyzed: Problem A with constant pressure and a fixed circular opening (the siphon); Problem B with constant volume and a fixed circular opening (the medicine dropper); and Problem C with prescribed volume and a constant angle of contact with a horizontal plate. As examples, the results are verified. For Problem B it is shown that if the opening is small enough to support a stable pendent drop with a bulge, then as the exposed volume is increased, stable pendent drops with both a neck and a bulge will be formed. For Problem C it is shown that with increasing volume the profile curves for the family of stable pendent drops will develop an inflection point before instability arises. Author

N82-23457*# Wisconsin Univ. - Madison. Mathematics Research Center.

CAPILLARY SURFACE DISCONTINUITIES ABOVE RE-ENTRANT CORNERS

H. J. Korevaar *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 295-302 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A particular configuration of a vertical capillary tube for which S is the equilibrium interface between two fluids in the presence of a downward pointing gravitational field was investigated. S is the graph a function u whose domain is the (horizontal) cross section gamma of the tube. The mean curvature of S is proportional to its height above a fixed reference plane and lambda is a prescribed constant and may be taken between zero and pi/2. Domains gamma for which us is a bounded function but does not extend continuously to d gamma are sought. Simple domains are found and the behavior of u in those domains is studied. An important comparison principle that has been used in the literature to derive many of the results in capillarity is reviewed. It allows one to deduce the approximate shape of a capillary surface by constructing comparison surfaces with mean curvature and contact angle close to those of the (unknown) solution surface. In the context of nonparametric problems the comparison principle leads to height estimates above and below for the function u. An example from the literature where these height estimates have been used successfully is described. The promised domains for which the bounded u does not extend continuously to the boundary are constructed. The point on the boundary at which u has a jump discontinuity will be the vertext of a re-entrant corner having any interior angle theta > pi. Using the comparison principle the behavior of u near this point is studied. J.D.

N82-23458*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.

FLUID MODELS AND SIMULATIONS OF BIOLOGICAL CELL PHENOMENA

H. P. Greenspan *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 303-307 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The dynamics of coated droplets are examined within the context of biofluids. Of specific interest is the manner in which the shape of a droplet, the motion within it as well as that of aggregates of droplets can be controlled by the modulation of surface properties and the extent to which such fluid phenomena are an intrinsic part of cellular processes. From the standpoint of biology, an objective is to elucidate some of the general dynamical features that affect the disposition of an entire cell, cell colonies and tissues. Conventionally averaged field variables of continuum mechanics are used to describe the overall global effects which result from the myriad of small scale molecular interactions. An attempt is made to establish cause and effect relationships from correct dynamical laws of motion rather than by what may have been unnecessary invocation of metabolic or life processes. Several topics are discussed where there are strong analogies droplets and cells including: encapsulated droplets/cell membranes; droplet shape/cell shape; adhesion and spread of a droplet/cell motility and adhesion; and oams and multiphase flows/cell aggregates and tissues. Evidence is presented to show that certain concepts of continuum theory such as suface tension, surface free energy, contact angle, bending moments, etc. are relevant and applicable to the study of cell biology. M.G.

N82-23459*# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.

CAPILLARY FORCES EXERTED BY LIQUID DROPS CAUGHT BETWEEN CROSSED CYLINDERS. A 3-D MENISCUS PROBLEM WITH FREE CONTACT LINE

T. W. Patzek and L. E. Scriven *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 308-314 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The Young-Laplace equation is solved for three-dimensional menisci between crossed cylinders, with either the contact line fixed or the contact angle prescribed, by means of the Galerkin/finite element method. Shapes are computed, and with them the practically important quantities: drop volume, wetted area, capillary pressure force, surface tension force, and the total force exerted by the drop on each cylinder. The results show that total capillary force between cylinders increases with decreasing contact angle, i.e. with better wetting. Capillary force is also increases with decreasing drop volume, approaching an asymptotic limit. However, the wetted area on each cylinder decreases with decreasing drop volume, which raises the question of the optimum drop volume to strive for, when permanent bonding is sought from solidified liquid. For then the strength of the bond is likely to depend upon the area of contact, which is the wetted area when the bonding agent was introduced in liquid form. M.G.

N82-23460*# University Coll., London (England). Dept. of Mathematics.

THE MOTION OF A DROP IN A RIGID SURFACE

L. M. Hocking *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 315-321 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The assumptions of a region of slip near a moving contact line (to remove the force singularity) and a constant contact angle are used to obtain the equation for the shape of a thin drop of liquid resting on a rigid plane. Three asymptotic expansions are matched together to obtain an expression for the rate at which the drop spreads. Some cases of sliding motion are also examined. Although the technique is presented here for thin drops only, it can also be applied to drops of arbitrary size.

Author

N82-23461*# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.

PROFILES OF ELECTRIFIED DROPS AND BUBBLES

O. A. Basaran and L. E. Scriven *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 322-329 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Axisymmetric equilibrium shapes of conducting drops and bubbles, (1) pendant or sessile on one face of a circular parallel-plate capacitor or (2) free and surface-charged, are found by solving simultaneously the free boundary problem consisting of the augmented Young-Laplace equation for surface shape and the Laplace equation for electrostatic field, given the surface potential. The problem is nonlinear and the method is a finite element algorithm employing Newton iteration, a modified frontal solver, and triangular as well as quadrilateral tessellations of the domain exterior to the drop in order to facilitate refined analysis of sharply curved drop tips seen in experiments. The stability limit predicted by this computer-aided theoretical analysis agrees well with experiments. M.G.

N82-23462*# Israel Meteorological Service, Bet Dagan. Dept. of Research and Development.

A NUMERICAL METHOD FOR INTEGRATING THE KINETIC EQUATIONS OF DROPLET SPECTRA EVOLUTION BY CONDENSATION/EVAPORATION AND BY COALESCENCE/BREAKUP PROCESSES

Issac M. Emukashvily *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 330-335 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

An extension of the method of moments is developed for the numerical integration of the kinetic equations of droplet spectra evolution by condensation/evaporation and by coalescence/breakup processes. The number density function n sub k (x,t) in each separate droplet packet between droplet mass grid points (x sub k, x sub k+1) is represented by an expansion in orthogonal polynomials with a given weighting function. In this way droplet number concentrations, liquid water contents and other moments in each droplet packet are conserved and the problem of solving the kinetic equations is replaced by one of solving a set of coupled differential equations for the number density function moments. The method is tested against analytic solutions of the corresponding kinetic equations. Numerical results are obtained for different coalescence/breakup and condensation/evaporation kernels and for different initial droplet spectra. Also droplet mass grid intervals, weighting functions, and time steps are varied. Author

N82-23463*# Wisconsin Univ. - Madison. Dept. of Mathematics.

BUBBLE IN A CORNER FLOW

Jean-Marc Vanden-Broeck *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 336-343 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A01/MF A01 CSCL 20D

The distortion of a two-dimensional bubble (or drop) in a corner of angle delta, due to the flow of an inviscid incompressible fluid around it, is examined theoretically. The flow and the bubble shape are determined as functions of the angle delta, the contact angle beta and the cavitation number gamma. The problem is formulated as an integrodifferential equation for the bubble surface. This equation generalized the integrodifferential equations derived by Vanden-Broeck and Keller. The shape of the bubble is found approximately by using the slender body theory for bubbles. When gamma reaches a critical value gamma sub 0 (beta, delta), opposite sides of the bubble touch each other. Two different families of solution for gamma < gamma sub 0 are obtained. In the first family opposite sides touch at one point. In the second family contact is allowed along a segment. M.G.

N82-23464*# Iowa Univ., Iowa City. Dept. of Mathematics.

ASYMPTOTIC EXPANSIONS AND ESTIMATES FOR THE CAPILLARY PROBLEM

Frederc Paul Brulois *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 344-349 (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The asymptotic properties for the small Bond number B of the equilibrium capillary interface interior to a circular cylindrical tube vertically dipped in an infinite reservoir of liquid are discussed. (The Bond number B is a dimensionless parameter which is the ratio of gravitational to capillary forces.) The formal expansion in powers of B of the solution to the differential equation describing the equilibrium surface (as can be obtained by standard perturbation methods) is proved to be truly asymptotic -- to all orders and uniformly in the variable and parameter gamma, the contact angle. Sequences of general estimates, in closed form, from above and from below, are also given for the solution and related functions. The M-th term in these sequences are asymptotically exact to order m. An idiosyncrasy of the problem, crucial in obtaining these estimates, is the absolute monotonicity of the structural function of the system in integral form. R.J.F.

N82-23465*# San Diego State Univ., Calif. Dept. of Mathematics.

THE NUMERICAL ANALYSIS OF THE ROTATIONAL THEORY FOR THE FORMATION OF LUNAR GLOBULES

James Ross, John Bastin (Queen Mary Coll.), and Kris Stewart (New Mexico Univ.) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 350-357 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The morphology of lunar globules is studied through the application of a numerical analysis of their rotation in space during cooling. It is assumed that molten rock is shot from the surface of the moon, solidifies in space above the moon and then falls back to the surface. The rotational theory studied makes the following assumptions: the volume of the molten rock does not change during cooling; the angular momentum is conserved; there are no internal motions because of the high viscosity of the molten rock, i.e., in equilibrium the globule is rotating as a

rigid body; finally, the kinetic reaction of the globule to the forces is fast relative to the rate of cooling, i.e., the globule reaches equilibrium at constant energy. These assumptions are subjected to numerical analysis yielding good agreement between the actual globule shapes and the numerical results, but leaving some doubt as to the validity of the rotational theory due to the failure to establish the existence of true local minima and an incomplete understanding of the thermokentics. R.J.F.

N82-23466*# California Univ., Davis. Dept. of Mechanical Engineering.

NUMERICAL METHODS AND CALCULATIONS FOR DROPLET FLOW, HEATING AND IGNITION

H. A. Dwyer, B. R. Sanders (Sandia National Labs., Livermore, Calif.), and D. Dandy (Sandia National Labs., Livermore, Calif.) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 358-365 refs Sponsored by DOE (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

A numerical method was devised and employed to solve a variety of problems related to liquid droplet combustion. The basic transport equations of mass, momentum and energy were formulated in terms of generalized nonorthogonal coordinates, which allows for adaptive griding and arbitrary particle shape. Example problems are solved for internal droplet heating, droplet ignition and high Reynolds number flow over a droplet. R.J.F.

N82-23467*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

EFFECTS OF ROTATION AND MAGNETIC FIELD ON THE ONSET OF CONVECTIVE INSTABILITY IN A LIQUID LAYER DUE TO BUOYANCY AND SURFACE TENSION

Gabbita Sundara Rama Sarma *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 366-373 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

Thermocapillary stability characteristics of a horizontal liquid layer heated from below rotating about a vertical axis and subjected to a uniform vertical magnetic field are analyzed under a variety of thermal and electromagnetic boundary conditions. Results based on analytical solutions to the pertinent eigenvalue problems are discussed in the light of earlier work on special cases of the more general problem considered here to show in particular the effects of the heat transfer, nonzero curvature and gravity waves at the two-fluid interface. Although the expected stabilizing action of the Coriolis and Lorentz force fields in this configuration are in evidence the optimal choice of an appropriate range for the relevant parameters is shown to be critically dependent on the interfacial effects mentioned above. R.J.F.

N82-23468*# Rome Univ. (Italy). Ist. Matemtico.

A VARIATIONAL APPROACH TO THE STUDY OF CAPILLARY PHENOMENA

Michele Emmer, Eduardod Gonzalez (Lecce Univ.), and Italo Tamanini (Trento Univ.) *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 374-379 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A17/MF A01 CSCL 20D

The problem of determining the free surface of a liquid in a capillary tube, and of a liquid drop, sitting first on a horizontal plane and then on more general surfaces is considered. With some modifications, the method applies to the study of pendent drops and of rotating drops as well. The standard capillary problem, i.e. the determination of the free surface of a liquid in a thin tube of general cross section, which resuls from the simultaneous action of surface tension, boundary adhesion and gravity is discussed. It turns out that in this case the existence of the solution surface depends heavily on the validity of a simple geometric condition about the mean curvature of the boundary curve of the cross section of the capillary tube. Some particular examples of physical interest are also be discussed. Liquid drops sitting on or hanging from a fixed horizontal plane are discussed. The symmetry of the solutions (which can actually be proved, as consequence of a general symmetrization argument) now plays the chief role in deriving both the existence and the regularity of energy-minimizing configurations. When symmetry fails (this is the case, for example, when the contact angle between the drop and the plate is not constant, or when the supporting surface is not itself symmetric), then more sophisticated methods must be used. Extensions in this direction are outlined. R.J.F.

N82-23469*# National Inst. of Health, Bethesda, Md. Biomedical Engineering and Instrumentation.

MECHANICS OF COUPLE-STRESS FLUID COATINGS

Allen M. Waxman *In* JPL Proc. of the 2d Intern. Colloq. on Drops and Bubbles 1 Mar. 1982 p 380-383 refs (For primary document see N82-23418 14-34)

Avail: NTIS HC A01/MF A01 CSCL 20D

The formal development of a theory of viscoelastic surface fluids with bending resistance - their kinematics, dynamics, and rheology are discussed. It is relevant to the mechanics of fluid drops and jets coated by a thin layer of immiscible fluid with rather general rheology. This approach unifies the hydrodynamics of two-dimensional fluids with the mechanics of an elastic shell in the spirit of a Cosserat continuum. There are three distinct facets to the formulation of surface continuum mechanics. Outlined are the important ideas and results associated with each: the kinematics of evolving surface geometries, the conservation laws governing the mechanics of surface continua, and the rheological equations of state governing the surface stress and moment tensors. R.J.F.

N82-23470*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NUMERICAL SOLUTION OF POTENTIAL FLOW ABOUT ARBITRARY 2-DIMENSIONAL MULTIPLE BODIES

Joe F. Thompson (Mississippi State Univ.) and Frank C. Thames [1982] 100 p refs

(Grant NGR-25-001-055)

(NASA-TM-84737; NAS 1.15:84737; MSSU-EIRS-ASE-82-2)

Avail: NTIS HC A05/MF A01 CSCL 20D

A procedure for the finite-difference numerical solution of the lifting potential flow about any number of arbitrarily shaped bodies is given. The solution is based on a technique of automatic numerical generation of a curvilinear coordinate system having coordinate lines coincident with the contours of all bodies in the field, regardless of their shapes and number. The effects of all numerical parameters involved are analyzed and appropriate values are recommended. Comparisons with analytic solutions for single Karman-Trefftz airfoils and a circular cylinder pair show excellent agreement. The technique of application of the boundary-fitted coordinate systems to the numerical solution of partial differential equations is illustrated. S.L.

N82-23471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BLOCKAGE AND FLOW STUDIES OF A GENERALIZED TEST APPARATUS INCLUDING VARIOUS WING CONFIGURATIONS IN THE LANGLEY 7-INCH MACH 7 PILOT TUNNEL

Cindy W. Albertson Mar. 1982 50 p

(NASA-TM-83301; NAS 1.15:83301) Avail: NTIS HC A03/MF A01 CSCL 20D

A 1/12th scale model of the Curved Surface Test Apparatus (CSTA), which will be used to study aerothermal loads and evaluate Thermal Protection Systems (TPS) on a fuselage-type configuration in the Langley 8-Foot High Temperature Structures Tunnel (8 ft HTST), was tested in the Langley 7-Inch Mach 7 Pilot Tunnel. The purpose of the tests was to study the overall flow characteristics and define an envelope for testing the CSTA in the 8 ft HTST. Wings were tested on the scaled CSTA model to select a wing configuration with the most favorable characteristics for conducting TPS evaluations for curved and intersecting surfaces. The results indicate that the CSTA and selected wing configuration can be tested at angles of attack up to 15.5 and 10.5 degrees, respectively. The base pressure for both models was at the expected low level for most test conditions. Results generally indicate that the CSTA and wing configuration will provide a useful test bed for aerothermal pads and thermal structural concept evaluation over a broad range of flow conditions in the 8 ft HTST. Author

N82-23472# Cambridge Univ. (England). Engineering Lab.

MEASUREMENT OF MEAN FLOW AND REYNOLD'S STRESSES IN A CURVED RECTANGULAR DUCT WITH

CROSSED (X) HOT WIRE
Tsun-Cheng Wang 1982 46 p refs
(ISSN-0309-6521) Avail: NTIS HC A03/MF A01

The results of an experimental investigation into the flow losses in a bend with rectangular cross section are described. Detailed hot-wire measurements determined the mean velocity components and Reynolds' stresses in the exit plane, and these results were used to study current turbulence models. Considerable anisotropy was observed which prevented a definition of scalar eddy viscosity from the experimental results. M.G.

N82-23473*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL ASPECTS OF HEAT TRANSFER IN STRUCTURES
Howard M. Adelman, Comp. 1982 554 p refs Symp. held at Hampton, Va., 3-5 Nov. 1981; sponsored by NASA, George Washington Univ., and Old Dominion Univ.
(NASA-CP-2216; L-15108; NAS 1.55:2216) Avail: NTIS HC A24/MF A01 CSCL 20D

Techniques for the computation of heat transfer and associated phenomena in complex structures are examined with an emphasis on reentry flight vehicle structures. Analysis methods, computer programs, thermal analysis of large space structures and high speed vehicles, and the impact of computer systems are addressed. For individual titles, see N82-23474 through N82-23499.

N82-23474*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASTRAN THERMAL ANALYZER IN A UNIFIED FINITE-ELEMENT TREATMENT OF THERMO-STRUCTURAL ANALYSES
Hwa-Ping Lee *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 1-22 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

The NASTRAN thermal analyzer (NTA) which performs large-scale unified thermo-structural analyses with the NASTRAN (NASA structural analysis) computer program is described. The mathematical similitude between these two distinct disciplines of thermal and structure is examined. It serves as the theoretical basis upon which the implementation of the thermal capability in NASTRAN was accomplished. The program structure, the functional flow, the solution algorithms, the organization of an input data deck and the solution capabilities of NTA are summarized. Emphasis is placed on the interface of the unified approach in thermo-structural analyses where stresses, deflections, vibrations and bucklings induced by the effect of temperature change are of concern. Attentions are also directed to the preprocessor and post processors. As a specially designed preprocessor, the VIEW program is capable of generating exchange factors which can be output, at user's option, in formats compatible with that required by NTA. Two post processors that serve specific objectives are included. They are the thermal variance analysis and the graphical displaying capability of temperatures in color or black and white. M.G.

N82-23475*# Tennessee Univ., Knoxville.
THERMAL CAPABILITIES AND GRAPHICAL OUTPUT OF PAFEC
J. E. Akin *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 21-33 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

The program for automatic finite element calculations (PAFEC) developed for the computation of heat transfer in structures is discussed. The passive and interactive graphics capabilities of the PAFEC system are presented and future developments are outlined. This finite element system is shown to have significant thermal capabilities in support of its general structures. The program offers the following types of analysis: interactive graphics; user defined program control steps; steady state, transient heat transfer; boundary element methods; linear static, stress and displacements; modes and freqencies calculations; direct dynamic time intergration; frequency response analysis; elastohydrodynamic lubrication; large deflection analysis, buckling; creep and plasticity analysis; and substructures analysis. M.G.

N82-23476*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE SPAR THERMAL ANALYZER: PRESENT AND FUTURE
M. B. Marlowe (Engineering Information Systems, Inc., San Jose, Calif.), W. D. Whetstone (Engineering Information Systems, Inc., San Jose, Calif.), and J. C. Robinson *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 35-50 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

The SPAR thermal analyzer, a system of finite-element processors for performing steady-state and transient thermal analyses, is described. The processors communicate with each other through the SPAR random access data base. As each processor is executed, all pertinent source data is extracted from the data base and results are stored in the data base. Steady state temperature distributions are determined by a direct solution method for linear problems and a modified Newton-Raphson method for nonlinear problems. An explicit and several implicit methods are available for the solution of transient heat transfer problems. Finite element plotting capability is available for model checkout and verification. M.G.

N82-23477*# Washington Univ., Seattle.
A COMPARISON OF THE FINITE DIFFERENCE AND FINITE ELEMENT METHODS FOR HEAT TRANSFER CALCULATIONS
A. F. Emery and H. R. Mortazavi *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 51-82 refs (For primary document see N82-23473 14-34)
(Grant NAG1-41)
Avail: NTIS HC A24/MF A01 CSCL 20D

The finite difference method and finite element method for heat transfer calculations are compared by describing their bases and their application to some common heat transfer problems. In general it is noted that neither method is clearly superior, and in many instances, the choice is quite arbitrary and depends more upon the codes available and upon the personal preference of the analyst than upon any well defined advantages of one method. Classes of problems for which one method or the other is better suited are defined. M.G.

N82-23478*# MacNeal-Schwendler Corp., Los Angeles, Calif.
A METHOD TO MODEL LATENT HEAT FOR TRANSIENT ANALYSIS USING NASTRAN
Robert L. Harder *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 83-89 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

A sample heat transfer analysis is demonstrated which includes the heat of fusion. The method can be used to analyze a system with nonconstant specific heat. The enthalpy is introduced as an independent degree of freedom at each node. The user input consists of a curve of temperature as a function of enthalpy, which may include a constant temperature phase change. The basic NASTRAN heat transfer capability is used to model the effects of latent heat with existing direct matrix output and nonlinear load data cards. Although some user care is required, the numerical stability of the integration is quite good when the given recommendations are followed. The theoretical equations used and the NASTRAN techniques are shown. M.G.

N82-23479*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME ASPECTS OF ALGORITHM PERFORMANCE AND MODELING IN TRANSIENT THERMAL ANALYSIS OF STRUCTURES
Howard M. Adelman, Raphael T. Haftka (Virginia Polytechnic Institute and State Univ.), and James C. Robinson *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 91-98 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

The status of an effort to increase the efficiency of calculating transient temperature fields in complex aerospace vehicle structures is described. The advantages and disadvantages of explicit and implicit algorithms are discussed. A promising set of implicit algorithms with variable time steps, known as the GEAR package is described. Four test problems, used for

evaluating and comparing various algorithms, were selected and finite element models of the configurations are described. These problems include a space shuttle frame component, an insulated cylinder, a metallic panel for a thermal protection system, and a model of the space shuttle orbiter wing. Results generally indicate a preference for implicit oer explicit algorithms for solution of transient structural heat transfer problems when the governing equations are stiff. M.G.

N82-23480*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

ALGORITHMIC ASPECTS OF TRANSIENT HEAT TRANSFER PROBLEMS IN STRUCTURES

Raphael T. Haftka and M. Hassan Kadivar (Illinois Institute of Technology) *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 99-114 refs (For primary document see N82-23473 14-34)
(Contract NsG-1266)
Avail: NTIS HC A24/MF A01 CSCL 20D

It is noted that the application of finite element or finite difference techniques to the solution of transient heat transfer problems in structures often results in a stiff system of ordinary differential equations. Such systems are usually handled most efficiently by implicit integration techniques which require the solution of large and sparse systems of algebraic equations. The assembly and solution of these systems using the incomplete Cholesky conjugate gradient algorithm is examined. Several examples are used to demonstrate the advantage of the algorithm over other techniques. M.G.

N82-23481*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF AN IMPROVED FINITE-ELEMENT THERMAL STRESS CALCULATION TECHNIQUE

Charles J. Camarda *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 115-131 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

A procedure for generating accurate thermal stresses with coarse finite element grids (Ojalvo's method) is described. The procedure is based on the observation that for linear thermoelastic problems, the thermal stresses may be envisioned as being composed of two contributions; the first due to the strains in the structure which depend on the integral of the temperature distribution over the finite element and the second due to the local variation of the temperature in the element. The first contribution can be accurately predicted with a coarse finite-element mesh. The resulting strain distribution can then be combined via the constitutive relations with detailed temperatures from a separate thermal analysis. The result is accurate thermal stresses from coarse finite element structural models even where the temperature distributions have sharp variations. The range of applicability of the method for various classes of thermostructural problems such as in-plane or bending type problems and the effect of the nature of the temperature distribution and edge constraints are addressed. Ojalvo's method is used in conjunction with the SPAR finite element program. Results are obtained for rods, membranes, a box beam and a stiffened panel. M.G.

N82-23482*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEVELOPMENT OF A REDUCED BASIS TECHNIQUE FOR TRANSIENT THERMAL ANALYSIS

Charles P. Shore *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 133-146 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

A technique to reduce the degrees of freedom in static and dynamic problems, the reduced basis method, is described. The method combines the classical Rayleigh-Ritz approximation with contemporary finite element methods to retain modeling versatility as the degrees of freedom are reduced. Applications to a nonlinear dynamic response problem are discussed efforts to apply the method to nonlinear transient thermal response problems are summarized. The selection of basis vectors for reducing the system of equations is addressed. M.G.

N82-23483*# Old Dominion Univ., Norfolk, Va.

APPLICATIONS OF PERTURBATION TECHNIQUES

Osama A. Kandil *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 147-160 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

Two perturbation techniques were applied to two singular perturbation problems in heat transfer to obtain uniformly valid solutions which can serve as benchmarks for finite difference and finite element techniques. In the first problem, the method of strained parameters coupled with the application of a solvability condition is used to obtain a uniform solution for the problem of unsteady heat conduction in a long nearly circular cylinder. In the second problem, the method of matched asymptotic expansion coupled with Van Dyke's matching principle is used to obtain a uniform solution for the problem of one dimensional conduction-convection heat transfer of a uniform fluid flow. M.G.

N82-23484*# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.

DEVELOPMENT OF MIXED TIME PARTITION PROCEDURES FOR THERMAL ANALYSIS OF STRUCTURES

Wing Kam Liu *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 161-178 refs (For primary document see N82-23473 14-34)
(Grant NAG1-210)
Avail: NTIS HC A24/MF A01 CSCL 20D

The computational methods used to predict and optimize the thermal-structural behavior of aerospace vehicle structures are reviewed. In general, two classes of algorithms, implicit and explicit, are used in transient thermal analysis of structures. Each of these two methods has its own merits. Due to the different time scales of the mechanical and thermal responses, the selection of a time integration method can be a difficult yet critical factor in the efficient solution of such problems. Therefore mixed time integration methods for transient thermal analysis of structures are being developed. This proposed methodology would be readily adaptable to existing comptuter programs for structural thermal analysis. Author

N82-23485*# Old Dominion Univ., Norfolk, Va.

INTEGRATED THERMAL-STRUCTURAL ANALYSIS OF LARGE SPACE STRUCTURES

Jack Mahaney and Earl A. Thornton *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 179-198 refs (For primary document see N82-23473 14-34)
(Grant NsG-1321)
Avail: NTIS HC A24/MF A01 CSCL 20D

Optimum performance of large space antennas requires very fine control of the shape of the antenna surface since the shape affects both frequency control and pointing accuracy. A significant factor affecting the antenna shape is the temperature of the structure and the resulting deformation. To accurately predict the temperature of the structure, it is necessary first to accurately predict thermal loads. As the structure orbits the Earth, the thermal loads change constantly so that the thermal-structural response varies continuously throughout the orbit. The results from recent applications of integrated finite element methodology to heat load determination and thermal-structural analysis of large space structures are given. Four areas are concentrated on: (1) the characteristics of the integrated finite element methodology, (2) fundamentals of orbital heat load calculation, (3) description and comparison of some radiation finite elements, and (4) application of the integrated finite-element approach to the thermal-structural analysis of an orbiting truss structure. R.J.F.

N82-23486*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INTERACTIVE MODELING, DESIGN AND ANALYSIS OF LARGE SPACECRAFT

L. Bernard Garrett *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 199-219 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

An efficient computer aided design and analysis capability applicable to large space structures was developed to relieve the engineer of much of the effort required in the past. The automated capabilities can be used to rapidly synthesize, evaluate,

and determine performance characteristics and costs for future large spacecraft concepts. The interactive design and evaluation of advanced spacecraft program (IDEAS) is used to illustrate the power, efficiency, and versatility of the approach. The coupling of space environment modeling algorithms with simplified analysis and design modules in the IDEAS program permits rapid evaluation of completing spacecraft and mission designs. The approach is particularly useful in the conceptual design phase of advanced space missions when a multiplicity of concepts must be considered before a limited set can be selected or more detailed analysis. Integrated spacecraft systems level data and data files are generated or subsystems and mission reexamination and/or refinement and for more rigorous analyses. R.J.F.

N82-23487*# Washington Univ., Seattle.
INTERACTIVE COMPUTATION OF RADIATION VIEW FACTORS
A. F. Emery, H. R. Mortazavi, and C. J. Kippenhan *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 221-241 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

The development of a pair of computer programs to calculate the radiation exchange view factors is described. The surface generatior. program is based upon current graphics capabilities and includes special provisions which are unique to the radiation problem. The calculational program uses a combination of contour and double area integration to permit consideration of radiation with obstruction surfaces. Examples of the surface generation and the calculation are given. Author

N82-23488*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RECENT DEVELOPMENTS IN THERMAL RADIATION SYSTEM ANALYZER (TRASYS)
Robert A. Vogt *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 234-251 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

Changes in the thermal radiation analyzer system (TRASYS) computer program are discussed. New capabilities were added while keeping intact the same data input structure. An overview of the program structure and general capabilities is given. Where appropriate, assessments are made of new features. The application of TRASYS peripheral programs and the importance they have in developing a totally integrated thermal analysis system are discussed. Form factor computations times were reduced approximately 40 percent, and the longer flux runs were reduced 50 percent when shadow tables were used. R.J.F.

N82-23489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROLE OF IAC IN LARGE SPACE SYSTEMS THERMAL ANALYSIS
G. K. Jones, J. T. Skladany, and J. P. Young *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 253-270 ref (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20C

Computer analysis programs to evaluate critical coupling effects that can significantly influence spacecraft system performance are described. These coupling effects arise from the varied parameters of the spacecraft systems, environments, and forcing functions associated with disciplines such as thermal, structures, and controls. Adverse effects can be expected to significantly impact system design aspects such as structural integrity, controllability, and mission performance. One such needed design analysis capability is a software system that can integrate individual discipline computer codes into a highly user-oriented/interactive-graphics-based analysis capability. The integrated analysis capability (IAC) system can be viewed as: a core framework system which serves as an integrating base whereby users can readily add desired analysis modules and as a self-contained interdisciplinary system analysis capability having a specific set of fully integrated multidisciplinary analysis programs that deal with the coupling of thermal, structures, controls, antenna radiation performance, and instrument optical performance disciplines. R.J.F.

N82-23490*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
REENTRY HEATING ANALYSIS OF SPACE SHUTTLE WITH COMPARISON OF FLIGHT DATA
Leslie Gong, Robert D. Quinn, and William L. Ko *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 271-294 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

Surface heating rates and surface temperatures for a space shuttle reentry profile were calculated for two wing cross sections and one fuselage cross section. Heating rates and temperatures at 12 locations on the wing and 6 locations on the fuselage are presented. The heating on the lower wing was most severe, with peak temperatures reaching values of 1240 C for turbulent flow and 900 C for laminar flow. For the fuselage, the most severe heating occured on the lower glove surface where peak temperatures of 910 C and 700 C were calculated for turbulent flow and laminar flow, respectively. Aluminum structural temperatures were calculated using a finite difference thermal analyzer computer program, and the predicted temperatures are compared to measured flight data. Skin temperatures measured on the lower surface of the wing and bay 1 of the upper surface of the wing agreed best with temperatures calculated assuming laminar flow. The measured temperatures at bays two and four on the upper surface of the wing were in quite good agreement with the temperatures calculated assuming separated flow. The measured temperatures on the lower forward spar cap of bay four were in good agreement with values predicted assuming laminar flow. Author

N82-23491*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
REENTRY HEAT TRANSFER ANALYSIS OF THE SPACE SHUTTLE ORBITER
William L. Ko, Robert D. Quinn, and Leslie Gong *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 295-325 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

A structural performance and resizing finite element thermal analysis computer program was used in the reentry heat transfer analysis of the space shuttle. Two typical wing cross sections and a midfuselage cross section were selected for the analysis. The surface heat inputs to the thermal models were obtained from aerodynamic heating analyses, which assumed a purely turbulent boundary layer, a purely laminar boundary layer, separated flow, and transition from laminar to turbulent flow. The effect of internal radiation was found to be quite significant. With the effect of the internal radiation considered, the wing lower skin temperature became about 39 C (70 F) lower. The results were compared with fight data for space transportation system, trajectory 1. The calculated and measured temperatures compared well for the wing if laminar flow was assumed for the lower surface and bay one upper surface and if separated flow was assumed for the upper surfaces of bays other than bay one. For the fuselage, good agreement between the calculated and measured data was obtained if laminar flow was assumed for the bottom surface. The structural temperatures were found to reach their peak values shortly before touch-down. In addition, the finite element solutions were compared with those obtained from the conventional finite difference solutions. R.J.F.

N82-23492*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE SHUTTLE ORBITER ENTRY HEATING AND TPS RESPONSE: STS-1 PREDICTIONS AND FLIGHT DATA
Robert C. Ried, Winston D. Goodrich, Chien P. Li, Carl D. Scott, Stephen M. Derry, and Robert J. Maraia *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 327-347 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

Aerothermodynamic development flight test data from the first orbital flight test of the Space Transportation System (STS) transmitted after entry blackout is given. Engineering predictions of boundary layer transition and numerical simulations of the

orbiter flow field were confirmed. The data tended to substantiate preflight predictions of surface catalysis phenomena. The thermal response of the thermal protection system was as expected. The only exception is that internal free convection was found to be significant in limiting the peak temperature of the structure in areas which do not have internal insulation. R.J.F.

N82-23493*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

TRANSIENT THERMAL ANALYSIS OF A TITANIUM MULTIWALL THERMAL PROTECTION SYSTEM

M. L. Blosser *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 349-361 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

The application of the SPAR thermal analyzer to the thermal analysis of a thermal protection system concept is discussed. The titanium multiwall thermal protection system concept consists of alternate flat and dimpled sheets which are joined together at the crests of the dimples and formed into 30 cm by 30 cm (12 in. by 12 in.) tiles. The tiles are mechanically attached to the structure. The complex tile geometry complicates thermal analysis. Three modes of heat transfer were considered: conduction through the gas inside the tile, conduction through the metal, and radiation between the various layers. The voids between the dimpled and flat sheets were designed to be small enough so that natural convection is insignificant (e.g., Grashof number < 1000). A two step approach was used in the thermal analysis of the multiwall thermal protection system. First, an effective normal (through-the-thickness) thermal conductivity was obtained from a steady state analysis using a detailed SPAR finite element model of a small symmetric section of the multiwall tile. This effective conductivity was then used in simple one dimensional finite element models for preliminary analysis of several transient heat transfer problems. B.W.

N82-23494*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HISTORICAL PERSPECTIVES ON THERMOSTRUCTURAL RESEARCH AT THE NACA LANGLEY AERONAUTICAL LABORATORY FROM 1948 TO 1958

Richard R. Heldenfels *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 363-392 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

Some of the early research on structural problems produced by aerodynamic heating, conducted at the Langley Aeronautical Laboratory of the National Advisory Committee for Aeronautics from 1948 to 1958 is described. That was the last decade of the NACA; in 1958 NACA became the nucleus of NASA. The NACA initially contracted for research but was aware that a well-equipped and suitably staffed laboratory was required to fulfill its obligations. Langley was established in 1920; the other listed were added during the NACA expansion in the World War II years. Some specific research activities are described, starting with calculation of the temperature of the structure. B.W.

N82-23495*# Naval Research Lab., Washington, D. C.

GUIDELINES FOR DEVELOPING VECTORIZABLE COMPUTER PROGRAMS

E. W. Miner *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 393-403 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

Some fundamental principles for developing computer programs which are compatible with array-oriented computers are presented. The emphasis is on basic techniques for structuring computer codes which are applicable in FORTRAN and do not require a special programming language or exact a significant penalty on a scalar computer. Researchers who are using numerical techniques to solve problems in engineering can apply these basic principles and thus develop transportable computer programs (in FORTRAN) which contain much vectorizable code. The vector architecture of the ASC is discussed so that the requirements of array processing can be better appreciated. The 'vectorization' of a finite-difference viscous shock-layer code is used as an example to illustrate the benefits and some of the difficulties involved. Increases in computing speed with vectorization are illustrated with results from the viscous shock-layer code and from a finite-element shock tube code. The applicability of these principles was substantiated through running programs on other computers with array-associated computing characteristics, such as the Hewlett-Packard (H-P) 1000-F. B.W.

N82-23496*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF THE SPAR THERMAL ANALYZER ON THE CYBER-203 COMPUTER

J. C. Robinson, K. M. Riley (Kentron International, Hampton, Va.), and R. T. Haftka (Virginia Polytechnic Institute and State Univ.) *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 405-424 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

The use of the CYBER 203 vector computer for thermal analysis is investigated. Strengths of the CYBER 203 include the ability to perform, in vector mode using a 64 bit word, 50 million floating point operations per second (MFLOPS) for addition and subtraction, 25 MFLOPS for multiplication and 12.5 MFLOPS for division. The speed of scalar operation is comparable to that of a CDC 7600 and is some 2 to 3 times faster than Langley's CYBER 175s. The CYBER 203 has 1,048,576 64-bit words of real memory with an 80 nanosecond (nsec) access time. Memory is bit addressable and provides single error correction, double error detection (SECDED) capability. The virtual memory capability handles data in either 512 or 65,536 word pages. The machine has 256 registers with a 40 nsec access time. The weaknesses of the CYBER 203 include the amount of vector operation overhead and some data storage limitations. In vector operations there is a considerable amount of time before a single result is produced so that vector calculation speed is slower than scalar operation for short vectors. B.W.

N82-23497*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DEVELOPMENT OF A CRAY 1 VERSION OF THE SINDA PROGRAM

Susan M. Juba and Peter E. Fogerson *In* NASA. Langley Research Center Computational Aspects of Heat Transfer in Struct. 1982 p 425-435 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

The SINDA thermal analyzer program was transferred from the UNIVAC 1110 computer to a CYBER And then to a CRAY 1. Significant changes to the code of the program were required in order to execute efficiently on the CYBER and CRAY. The program was tested on the CRAY using a thermal math model of the shuttle which was too large to run on either the UNIVAC or CYBER. An effort was then begun to further modify the code of SINDA in order to make effective use of the vector capabilities of the CRAY. Author

N82-23498*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN EVALUATION OF SUPERMINICOMPUTERS FOR THERMAL ANALYSIS

Olaf O. Storaasli, James B. Vidal (Digital Equipment Corp., Richard, Va.), and Gary K. Jones (NASA Goddard Space Flight Center) *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 437-451 refs (For primary document see N82-23473 14-34)

Avail: NTIS HC A24/MF A01 CSCL 20D

The use of superminicomputers for solving a series of increasingly complex thermal analysis problems is investigated. The approach involved (1) installation and verification of the SPAR thermal analyzer software on superminicomputers at Langley Research Center and Goddard Space Flight Center, (2) solution of six increasingly complex thermal problems on this equipment, and (3) comparison of solution (accuracy, CPU time, turnaround time, and cost) with solutions on large mainframe computers. B.W.

N82-23499*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURVEY OF COMPUTER PROGRAMS FOR HEAT TRANSFER ANALYSIS

Ahmed K. Noor *In its* Computational Aspects of Heat Transfer in Struct. 1982 p 487-561 refs (For primary document see N82-23473 14-34)
Avail: NTIS HC A24/MF A01 CSCL 20D

An overview is presented of the current capabilities of thirty-eight computer programs that can be used for solution of heat transfer problems. These programs range from the large, general-purpose codes with a broad spectrum of capabilities, large user community and comprehensive user support (e.g., ANSYS, MARC, MITAS 2 MSC/NASTRAN, SESAM-69/NV-615) to the small, special purpose codes with limited user community such as ANDES, NNTB, SAHARA, SSPTA, TACO, TEPSA AND TRUMP. The capabilities of the programs surveyed are listed in tabular form followed by a summary of the major features of each program. As with any survey of computer programs, the present one has the following limitations: (1) It is useful only in the initial selection of the programs which are most suitable for a particular application. The final selection of the program to be used should, however, be based on a detailed examination of the documentation and the literature about the program; (2) Since computer software continually changes, often at a rapid rate, some means must be found for updating this survey and maintaining some degree of currency. B.W.

N82-23500# Clemson Univ., S.C. Dept. of Mechanical Engineering.
ROTATIONAL FLOW IN A CURVED-WALL DIFFUSER DESIGNED BY USING THE INVERSE METHOD OF SOLUTION OF POTENTIAL FLOW THEORY
Tah-teh Yang and Francois Ntone 14 May 1981 15 p refs (AD-A111785) Avail: NTIS HC A02/MF A01 CSCL 20/4

Curved wall diffusers designed by using an inverse method of solution of potential flow theory have been shown to be both short and highly efficient. These features make this type of diffuser attractive in thrust ejector applications. In ejectors, however, the flow at the diffuser inlet is nearly a uniform shear flow. This paper presents a method used in examining the flow velocity along the diffuser wall and some of the analytical results for diffusers designed with potential flow theory and receiving a rotational flow. The inlet flow vorticity and the diffuser area ratios prescribed in the inverse solution of the irrotational flow are the parameters of the study. The geometry of a sample ejector using such a diffuser and its estimated thrust augmentation ratio are also presented. Author (GRA)

N82-23501# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
EQUATIONS GOVERNING THE LIQUID FILM FLOW OVER A PLANE WITH WALL HEAT FLUX AND INTERFACIAL PHASE CHANGE
Bertrand Spindler Feb. 1981 145 p refs In FRENCH
(CEA-R-5061) Avail: NTIS (US Sales Only) HC A07/MF A01; DOE Depository Libraries

In order to study the linear stability, by means of the perturbations method, of the flow of a liquid film down an inclined plane with heat flux at the wall and interfacial phase change, the equations describing the flow were examined and simplified. Two flow patterns were considered. In the first case, evaporation or condensation occurred on a preexisting film, whereas the second case corresponds to filmwise condensation. DOE

N82-23502# Commissariat a l'Energie Atomique, Grenoble (France). Dept. de Transfert et Conversion d'Energie.
INTERFACIAL AREA MEASUREMENTS IN TWO-PHASE BUBBLY FLOWS. PT. 1: COMPARISON BETWEEN THE LIGHT ATTENUATION TECHNIQUE AND THE PHOTOGRAPHIC METHOD
Jean-Michel Veteau and Roland Charlot Feb. 1981 60 p refs In FRENCH
(CEA-R-5075) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

In order to measure specific area by a light attenuation technique in bubbly stationary flows, the main features of an optical design are given. This method, valid for bubble sizes between 0.5 and several millimeters, is compared with a photographic technique. The latter gives values systematically higher (15 to 25%) than the former. The measured specific areas range from 0.5 to 2 cm (-1). The multiple sources of error inherent in the photographic method are discussed. DOE

N82-23503# Paris VI Univ. (France).
CONTRIBUTION TO THE STUDY OF HEAT TRANSFER MECHANISMS IN He. APPLICATION TO THE STABILIZATION OF SUPERCONDUCTORS BY SUPERFLUID He Ph.D. Thesis
Dominique Gentile Apr. 1980 159 p refs In FRENCH
(FRNC-TH-946) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

Models were developed of the mechanics of heat transfer between a solid and liquid or superfluid helium in the case where the thermal perturbation applied to the solid is of sufficiently long duration to be able to speak of continuous evacuation and where the perturbation is of short duration to speak of a transient state. The mechanics of heat transfer were studied in the steady state in the case of a channel locally heated in vertical and horizontal position by saturated helium and at one atmosphere. Heat transfer curves were obtained by measuring the temperature of the solid and the thermal gradients in the fluid. Numerical values are given for the maximum propagation flows and minimum recovery flows, heat transfer coefficients, thermal oscillation phenomena and hysteresis phenomena according to the geometrical parameters of the pipe, the surface state of the solid, the relative dimensions of the solid and the liquid volume, the state and nature of the fluid. The thermal fluctuations found experimentally in certain temperature and pressure conditions are interpreted in terms of the formation of gas bubbles on the surface of the solid and in terms of acoustic wave phenomena in the channel and the cavity created by the helium bath. DOE

N82-23504# Oak Ridge National Lab., Tenn. Energy Div.
DESIGN OPTIMIZATION AND THE LIMITS OF STEADY-STATE HEATING EFFICIENCY FOR CONVENTIONAL SINGLE-SPEED AIR-SOURCE HEAT PUMPS
C. K. Rice, S. K. Fischer, W. L. Jackson, and R. D. Ellison Oct. 1981 101 p refs
(Contract W-7405-eng-26)
(DE82-002485; ORNL/CON-63) Avail: NTIS HC A06/MF A01

ORNL Heat Pump Model and an optimizing program were used to explore the limits of steady-state heating efficiency for conventional air-source heat pumps. The method used allows for the simultaneous optimization of ten selected design variables, taking proper account of their interactions, while constraining other parameters to chosen limits or fixed values. Designs were optimized for a fixed heating capacity, but the results may be scaled to other capacities. Substantial performance improvement is predicted compared to today's state of the art heat pump. With increased component efficiencies that are expected in the near future and with modest increases in heat exchanger area, a 28% increase in heating efficiency is predicted; for long-term improvements with considerably larger heat exchangers, a 56% increase is possible. The improved efficiencies are accompanied by substantial reductions in the requirements for compressor and motor size. DOE

N82-23505# Energy Utilization Systems, Inc., Pittsburgh, Pa.
DEMONSTRATION OF A HEAT PUMP WATER HEATER, VOLUME 2 Final Report
Robert P. Blevins, Barry D. Sloane, and Gary E. Valli Jun. 1981 136 p refs Prepared for Oak Ridge National Lab.
(Contract W-7405-eng-26)
(DE82-001359; ORNL/SUB-7321/4-Vol-2) Avail: NTIS HC A07/MF A01

The field demonstration of electric heat pump water heaters is described. Eighty-five heat pump water heaters were installed in single family homes located in the service territories of 20 geographically and climatically dispersed electric utilities. The reliability and operating efficiency of the device was shown. Operating data were collected monthly, analyzed, and a monthly coefficient of performance was calculated for each unit. DOE

N82-23506# National Engineering Lab., East Kilbride (Scotland). Flow Measurement Div.
PREDICTION OF THE EFFECT OF SWIRLING FLOW ON ORIFICE PLATE MEASUREMENTS

A. McHugh, D. Dyet, and F. C. Kinghorn Jul. 1981 24 p refs Sponsored by UK Dept. of Industry's Metrology and Standard Requirements Board
(NEL-676) Avail: NTIS HC A02/MF A01

The rate of decay of the angular momentum flux in symmetrical swirling flow along a straight length of 203 mm dia pipe was measured in order to assess error induced by swirling flow when it is impossible to install a straightener. The effect of a change in the intensity of the swirling flow on the discharge coefficient of three orifice plates with varying area ratios was also measured. A relationship between the change in the orifice coefficient and the yaw angle at a given radial position upstream of the orifice was derived for the two smaller ratio orifice plates. This indicates that it might be possible to predict the coefficient of orifice plates in all types of symmetrical swirling flow by a similar measurement. Author (ESA)

N82-23507# National Engineering Lab., East Kilbride (Scotland). Dept. of Thermodynamics and Fluid Mechanics.

TWO-PHASE FLOW STUDIES IN LARGE DIAMETER HORIZONTAL TUBES

H. C. Simpson, D. H. Rooney, E. Grattan, and F. A. A. AlSamarrae Dec. 1981 63 p refs Sponsored by UK Dept. of Industry
(NEL-677) Avail: NTIS HC A04/MF A01

Experimental results of the flow of air/water mixtures in large diameter tubes at pressures close to atmospheric are summarized. Flow pattern data are compared with existing flow pattern maps in order to assess the effect of tube diameter. Pressure drop data are compared with friction correlations, in terms of a friction multiplier, and the problems associated with these correlations to flow in large diameter tubes are emphasized. Measurements of the settling lengths required after a double 90 deg bend and after an air/water mixing device are presented, as are data on void fractions. Data show a strong flow pattern dependency, which requires the transition between the flow regimes to be defined carefully. Instantaneous measurements of pressure and void fraction were recorded and analyzed statistically in order to provide an objective means of defining different flow patterns. Author (ESA)

N82-23508# National Engineering Lab., East Kilbride (Scotland). Dept. of Thermodynamics and Fluid Mechanics.

TWO-PHASE FLOW THROUGH GATE VALVES AND ORIFICE PLATES

E. Grattan, D. H. Rooney, and H. C. Simpson Dec. 1981 36 p refs Sponsored by UK Dept. of Industry
(NEL-678) Avail: NTIS HC A03/MF A01

Flow patterns in a 127 mm pipe containing different sizes of orifice plates and a variable opening gate valve were studied. Data for (a) pressure loss over the valve and orifice plates allowing for subsequent pressure recovery, indicating the restricting effect and (b) pressure difference over the orifice plates using D and D/2 pressure tappings similar to that used in flow-metering are presented. For (a), empirical expressions representing the experimental data are presented and the restricting effects of orifice plates and valves (at the same opening area) are compared. Valve pressure loss data are compared with two correlations from the literature. These correlations are shown to be inaccurate and unrepresentative. For (b), the data are compared with correlations from the literature. Reasonable agreement is obtained. Author (ESA)

N82-23509# Imperial Coll. of Science and Technology, London (England). Heat Transfer Section.

GENMIX 2P: NOTES AND LISTING

D. Brian Spalding Mar. 1981 73 p refs
(HTS/81/1) Avail: NTIS HC A04/MF A01

A computer code for representing two dimensional steady parabolic flows, or one-dimensional unsteady ones, with two interpenetrating phases is introduced. The one dimensional option can represent the gravitational effects associated with stratified flow, e.g., steam and water flowing in near horizontal pipes, or gas and oil flowing along pipelines on the sea bed.
Author (ESA)

N82-23510# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.

NUMERICAL COMPUTATION OF MULTI-PHASE FLOWS

D. Brian Spalding Nov. 1981 100 p refs Presented at Lecture Course, London, 2-6 Nov. 1981
(HTS/81/8) Avail: NTIS HC A05/MF A01

Numerical solution of two-phase flow equations, e.g., mixed steam-water-injected coolant flow following breaks in nuclear reactor pressure vessels, by the interphase slip algorithm (IPSA) is outlined. One-dimensional unsteady dispersed and gravity stratified flows are considered. One-dimensional unsteady flow with mass and heat transfer is dealt with. Two-dimensional steady dispersed flow, multi-dimensional two-phase flow, and two-phase flow with chemical reaction are discussed. The computer program used for IPSA is introduced. Author (ESA)

N82-23511# Imperial Coll. of Science and Technology, London (England). Computational Fluid Dynamics Unit.

COMPUTERS, TURBULENCE AND TWO-PHASE FLOW

D. Brian Spalding Jan. 1982 11 p refs
(CFD/82/3) Avail: NTIS HC A02/MF A01

Progress in modeling turbulent flow, and algorithms for computing two-phase flow were reviewed. Computer hardware and software are discussed. Computer codes simulate three-dimensional, unsteady, two phase flow in nuclear reactors and steam generators. For most liquid-liquid and liquid-gas flows, the division of the dispersed fluid, (droplet or bubble size) is unknown, producing differences between theoretical and experimental values. Turbulence models do not deal adequately with intermittency, unmixedness or two-phase effects. The PHOENICS computer code solves equations of single or two-phase, laminar or turbulent flow in one, two, or three dimensions. Author (ESA)

N82-23512# Oxford Univ. (England). Dept. of Engineering Science.

DESIGN OF WIDE-BANDWIDTH ANALOGUE CIRCUITS FOR HEAT TRANSFER INSTRUMENTATION IN TRANSIENT TUNNELS

M. L. G. Oldfield, H. J. Burd, and N. G. Doe 1981 41 p refs Sponsored by Science and Engineering Research Council and Rolls Royce Ltd.
(OUEL-1382/81) Avail: NTIS HC A03/MF A01

A method for designing analogs with a logarithmic scaling of the elements is described. This uses far fewer elements for a given bandwidth than previous designs and can retain 1% accuracy even when constructed from 20% tolerance capacitors. Theoretical analysis leads to computer programs which predict the performance of any analog in the frequency domain and the time domain. A design example of a low noise analog circuit, using nine sections for a frequency range of 0.1 to 100 kHz, is given.
Author (ESA)

N82-23513# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight/Informatics Div.

UNIAXIAL MODEL FOR GAS-LOADED VARIABLE CONDUCTANCE HEAT PIPE PERFORMANCE IN THE INERTIAL FLOW REGIME

A. A. M. Delil and J. vanderVooren 13 Mar. 1981 16 p refs Presented at 4th Intern. Heat Pipe Conf. London, 7-10 Sep. 1981
(Contract NIVR-1833)
(NLR-MP-81010-U) Avail: NTIS HC A02/MF A01

A model which accounts for diffusion at the vapor/gas interface as well as for inertial effects of the moving vapor is presented. Calculations show that the diffusion effects are of minor importance in comparison with the inertial effects, which can be considerable in a certain part of the VCHP operating range. For working fluids with relatively low vapor pressure (such as methanol, freons, liquid metals) this part of the operating range is the wide sonic regime; for other working fluids it is confined to temperatures near freeze out conditions. Results of calculations performed with an improved flat front model, derived from the uniaxial model by taking the limit or zero diffusivity, are given. These results predict VCHP performance and controllability figures significantly different from those obtained from the classical flat front theory, where inertial effects are neglected. Author (ESA)

N82-23171# West Virginia Univ., Morgantown. Coll. of Engineering.
UNSTEADY EJECTORS
Herman Viets *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 12 p refs (For primary document see N82-23150 14-01)
(Grant AF-AFOSR-0025-81)
Avail: NTIS HC A19/MF A01

N82-23175# Aeronautical Research Associates of Princeton, Inc., N. J.
ON THE INCLUSION OF INFORMATION ON EDDY STRUCTURE IN SECOND-ORDER-CLOSURE MODELS OF TURBULENT FLOWS
Coleman duP. Donaldson and Guido Sandri *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 14 p refs (For primary document see N82-23150 14-01)
(Contract F44620-76-C-0048)
Avail: NTIS HC A19/MF A01

N82-23176# Tennessee Univ., Knoxville. Dept. of Engineering and Mechanics.
A THREE-DIMENSIONAL FINITE ELEMENT ALGORITHM FOR PREDICTION OF V/STOL JET-INDUCED FLOW-FIELDS
A. J. Baker, P. D. Manhardt, J. A. Orzxechowski, and K. T. Yen (Naval Air Development Center, Warmister, Pa.) *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs Prepared in cooperation with Computational Mechanics Consultants, Inc. (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23178# Bochum Observatory (West Germany).
EFFECTS OF BUOYANCY AND ENTRAINMENT ON HOT FREE JETS AND WALL JETS
K. Gersten, F. V. Schulz-Hausmann, and S. Schilawa *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 9 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23179*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOL AIRCRAFT AND FLUID DYNAMIC
Leonard Roberts (Stanford Univ.) and Seth B. Anderson *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 5 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01 CSCL 01A

N82-23180# Technische Hochschule, Aachen (West Germany). Inst. Aerodynamisches.
INVESTIGATION OF WALL JETS
E. Krause, D. Haenel, and N. I. I. Newedy *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 5 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23181# Kingston Polytechnic, Kingston-Upon-Thames (England). School of Mechanical, Aeronautical and Production Engineering.
THE CALCULATION OF JET INTERFERENCE PRESSURE DISTRIBUTION USING INTEGRAL AND NUMERICAL METHODS BASED ON ACTUAL MEASUREMENTS OF ENTRAINMENT
Philip E. C. Ransom and John H. Barnes *In* AGARD Fluid Dyn. of Jets with Appl. to V/STOL Jan. 1982 8 p refs (For primary document see N82-23150 14-01)
Avail: NTIS HC A19/MF A01

N82-23366*# Federal Aircraft Establishment, Emmen (Switzerland). Thermodynamics Sect.
THE MECHANICAL DESIGN OF A VAPOR COMPRESSOR FOR A HEAT PUMP TO BE USED IN SPACE
Felix Berner, H. Oesch, K. Goetz, and C. J. Savage (ESA) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 329-340 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 20D

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N82-23514*# Lockheed Missiles and Space Co., Huntsville, Ala.
INTEGRATION AND SOFTWARE FOR THERMAL TEST OF HEAT RATE SENSORS Final Report
C. J. Wojciechowski and K. R. Shrider 9 Apr. 1982 41 p refs
(Contract NAS8-33522)
(NASA-CR-162004; NAS 1.26:162004; LMSC-HREC-TR-D-784800) Avail: NTIS HC A03/MF A01 CSCL 14B

A minicomputer controlled radiant test facility is described which was developed and calibrated in an effort to verify analytical thermal models of instrumentation islands installed aboard the space shuttle external tank to measure thermal flight parameters during ascent. Software was provided for the facility as well as for development tests on the SRB actuator tail stock. Additional testing was conducted with the test facility to determine the temperature and heat flux rate and loads required to effect a change of color in the ET tank external paint. This requirement resulted from the review of photographs taken of the ET at separation from the orbiter which showed that 75% of the external tank paint coating had not changed color from its original white color. The paint on the remaining 25% of the tank was either brown or black, indicating that it had degraded due to heating or that the spray on form insulation had receded in these areas. The operational capability of the facility as well as the various tests which were conducted and their results are discussed.
A.R.H.

N82-23515*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POCKELS-EFFECT CELL FOR GAS-FLOW SIMULATION
David Weimer May 1982 19 p refs
(NASA-TP-2007; E-1028; NAS 1.60:2007) Avail: NTIS HC A02/MF A01 CSCL 14B

A Pockels effect cell using a 75 cu cm DK*P crystal was developed and used as a gas flow simulator. Index of refraction gradients were produced in the cell by the fringing fields of parallel plate electrodes. Calibration curves for the device were obtained for index of refraction gradients in excess of .00025 m.
S.L.

N82-23516# Rockwell International Corp., Golden, Colo. Energy Systems Group.
PORTABLE 1/M METER
W. R. Sheets, G. A. Riordan, ed., and G. Shekell, comp. 1 Aug. 1981 19 p Revised
(Contract DE-AC04-76DP-03533)
(RFP-3058; DOE/TIC-4500-Rev-69) Avail: NTIS HC A02/MF A01

A portable 1/M instrument was designed and constructed. Its main purpose is to be available in the event 1/M data is needed in a suspected nuclear excursion. The unit was designed around a readily available four function calculator. The main unit including batteries and charger is contained in a 248 cu in cabinet weighing seven pounds. A second unit containing the preamp, high voltage power supply and BF3 counter tube interconnects to the main unit by a coaxial cable. The cable is several hundred feet long. This unit weighs 2.4 pounds. On command the instrument will store a 100 second background the instrument will store a 100 second background count or a 10 second data count. the 100 second count id averaged to 10 seconds when stored. When the 10 second data count is taken, the instrument reads out a value of 1/M and holds the reading until the next reading occurs.
S.L.

N82-23517# Monsanto Research Corp., Miamisburg, Ohio.
TEST AND EVALUATION OF AN ARGONNE NATIONAL LABORATORY SMALL SAMPLE CALORIMETER
Walter W. Rodenburg 30 Apr. 1981 17 p ref
(Contract DE-AC04-76DP-00053)
(MLM-2813) Avail: NTIS HC A02/MF A01

Details of an evaluation of the performance of the modified Argonne National Laboratory small sample calorimeter are discussed. The major problems identified in previous tests were resolved by the modifications. In particular, the baseline stability is much improved and, as a result, the instrument precision is 0.025 mW. This compares to 0.049 mW for the unmodified instrument. In addition, a calibration procedure is provided that utilizes an electrically heated capsule and a digital voltmeter. This new procedure provides a means for ensuring that the calibration has not changed. In addition, the microprocessor program was improved by clarifying the labels used in the output and by making operation simpler. In general, both the first instrument tested and the modified instrument have similar operating characteristics. Heat distribution errors are small. The times required to achieve equilibrium are similar. Both instruments are insensitive to operator and environmental effects. One exception, however, is that insertion of a cold capsule causes a baseline shift which was not detected in the first instrument tested. B.W.

N82-23518# Exxon Nuclear Idaho Co., Inc., Idaho Falls.
A NEW ICPP PORTAL MONITOR
M. A. Georgeson and C. E. Nichols Apr. 1981 21 p refs
(Contract DE-AC-7-79ID-01675)
(ENICO-1083) Avail: NTIS HC A02/MF A01

Low levels of beta and/or gamma contamination as well as gram quantities of special nuclear materials can be detected by a portal-mounted monitor even though the monitor is located in the presence of varying background levels of radiation. The detector consists of 14 area-wide gas proportional detectors, an occupancy monitor, an electronic system for signal and alarm logic, and support hardware. Each of the 14-15.3 and 35.6 cm propane purged detectors has a two to five mg/sq cm mylar cover and each detector has a total sensitive area of 450 sq cm. Six separate signal alarm and logic channels detect the presence of radioactivity and indicate whether the radiation is coming from the head, top right body, top left body, lower right body, lower left body, or the feet area, making it easier to locate the source and minimize personnel delay. The swinging door design of the monitor is such that anyone passing through must come into close proximity of the detectors and is slowed enough to allow for a meaningful scan without causing inordinate delays. A.R.H.

N82-23519# Toulouse Univ. (France).
ELECTRIC DOSEMETERS. APPLICATION IN RADIODIAGNOSIS Ph.D. Thesis
Jun. 1980 102 p refs In FRENCH
(FRNC-TH-950) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

This work relates the realization of a useful dosimeter in radiodiagnosis. The detection is founded on depolarization measurement of an electret submitted to X-rays. Several methods for the making of electrets with a polymer tip of low thickness are described. An assembly for the making and carrying out of the sample measurement is described. Also presented are the results obtained by two polarization methods. The relative importance of the two mechanisms which stem from these results are discussed. The shape of the curves is justified. DOE

N82-23520# Battelle Pacific Northwest Labs., Richland, Wash.
MULTIPURPOSE COMPUTER-CONTROLLED SCANNING PHOTOMETER
E. W. Kleckner, J. J. Michalsky, L. L. Smith, J. R. Schmelzer, R. H. Severtsen, and J. L. Berndt Nov. 1981 36 p refs
(Contract DE-AC06-76RL-01830)
(DE82-003628; PNL-4081) Avail: NTIS HC A03/MF A01

A design for a multipurpose computer-controlled scanning photometer capable of measuring optical radiation ranging in intensity from the subvisual light levels associated with night sky airglow emissions to the intense flux levels of direct sunlight is discussed. The instrument has twelve interference filters for wavelength selection, a 2.50 field of view for nighttime observations, and a 1.50 field of view for daytime observations. A photomultiplier tube is used as the low light-level detector, and a silicon-PIN photodiode serves as the insolation detector. A particular measurement sequence is programmed into the instrument and can be modified by reading a cassette tape in the field. Normal operation is fully automatic. DOE

N82-23521# Research Inst. of National Defence, Stockholm (Sweden).
INVESTIGATION WITH A PROTOTYPE MICROCALORIMETER [UNTERSUCHUNGEN MIT EINEM PROTOTYP EINES NEUEN MIKROKALORIMETERS DER FIRMA LKB]
Max Frey and Jan Hansson Nov. 1981 18 p In SWEDISH
(FOA-C-20430-D1) Avail: NTIS HC A02/MF A01

Precision and heat measurement stability were studied during determinations of the heat flow from normal decomposition of gunpowder. The microcalorimeter was equipped with several test channels, giving a greater operating capacity especially when reactions are very slow. The weight of the samples was 1 to 2 g. The tests lasted for 30 to 50 days at 80 C. The heat flow between samples and the thermostat was measured with Peltier elements, allowing a sensitivity of 1/1 million K. The water temperature varied within 1 or - 0.0002 K over 24 hours. Results are discussed for three types of gunpowder, pulverized and coarse. Author (ESA)

N82-23522# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.
A PARTICLE SPECTROMETER WITH A LARGE GEOMETRIC FACTOR FOR THE ENERGY RANGE 0.1 TO 30 keV
A. Urban Apr. 1981 22 p refs Sponsored by Austrian Council for Science Research and Austrian Acad. of Sciences
(INW-8104) Avail: NTIS HC A02/MF A01

The design and the calibration of a detector using a channel electron multiplier (CEM) together with a spherical electrostatic analyzer are described. The CEM characteristic equivalent energy band widths, opening angles, and sensitive areas are defined and are given as functions of energies between 0.1 to 25 keV. The analyzer deflection high voltage, the CEM acceleration high voltage, the measurement control unit and the data processing interfaces are described. The numerical analysis of the geometric factor from the calibration data is demonstrated. Energy and pitch angle distribution of energetic electrons were measured. The 90 deg sensor detects a constant energy spectrum over the entire period, while the 30 deg sensor exhibits large variations. Changes in trapped particle pitch angle distribution (from isotropic at 154 to 156 sec flight time to anisotropic above 157 sec at the lowest and highest energies) explains the variations. Author (ESA)

N82-23523# AEG-Telefunken, Heilbronn (West Germany).
DEVELOPMENT OF AN ELECTRONIC TIMEPIECE FOR TECHNICAL APPLICATION
Hans Peter Wolf Dec. 1981 48 p refs Transl. into ENGLISH of "Integrierte Schlatung fuer Elektronische Zeistgeber mit Quarzsteuerung fuer Technishce Anwendung" Rept. T79-88 Bundesministerium fuer Forschung und Technologie, Bonn, Dec. 1979
(PB82-128430; BMFT-FB-T-79-88) Avail: NTIS HC A03/MF A01 CSCL 14B

The development of technology and circuit of an electronic timepiece in integrated injection logic technique is described. The process sequence is given and the technological process steps are described. The characterization of the technology is done by means of the electrical data. Starting with the principle of the entire circuit the function and characteristic of the individual stages and the electrical data of the main system are given. GRA

N82-23524# Arizona Univ., Tucson.
THE INFLUENCE OF ADJACENCY EFFECTS ON THE RESTORATION OF NOISY PHOTOGRAPHIC IMAGES Ph.D. Thesis
Ronald Leon Antos 1981 182 p
Avail: Univ. Microfilms Order No. 8200324

The application and appropriate modification of a restoration model for the removal of adjacency effects from noisy images of selected line targets was investigated. Literature pertaining to

the initial observations of adjacency effects, their recognition as a nonlinear chemical development effect and the pertinent models (forward) used to predict their effects was reviewed. The statistical restoration (inverse) model is reviewed and compared to previously derived forward models. A chemical spread function to charactierize chemical adjacency effects was empirically determined using a segmented polynomial (cubic spline function) approach. Separate light quanta exposures were used to obtain gross grain density sensitometric curves and noisy line images. The covering power relationship between mass of developed silver and diffuse density was empirically derived for Panatomic -X film processed without agitation in D-76 developer (diluted 1:1). Chemical adjacency effects were successfully removed from noisy line images using an appropriately scaled version of the statistical restoration model. The spatial frequency content of the noisy line images was approximately 1, 10, 15, 20, 25 and 40 cycles/mm. Dissert. Abstr.

N82-23357*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NATIONAL GEOTECHNICAL CENTRIFUGE

James A. Hallam, Nans Kunz, and Wilbur C. Vallotton *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 201-210 (For primary document see N82-23344 14-31) Avail: NTIS HC A15/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N82-23525 National Physical Lab., Teddington (England). Div. of Mechanical and Optical Metrology.

POWER SHIFTS OF A 633-NM 127I2 STABILIZED He-Ne LASER, FOR VARIOUS MIRROR CURVATURES

W. R. C. Rowley Dec. 1981 20 p refs

(NPL-MOM-56; ISSN-0309-3069) Copyright. Avail: NTIS HC A02/MF A01

Beat frequency measurements were made by comparison with a reference laser, of the frequency shifts at different output powers of a 633 nm He-Ne laser stabilized by intracavity saturated absorption to hyperfine components e and f of iodine 127. Results show that at normal output powers the stabilized frequency and the power shift coefficients depend on the curvatures of the cavity mirrors. At low powers the coefficients are larger than at normal powers, but the absolute laser frequency is less sensitive to the mirror curvatures. Results indicate that certain combinations of mirror curvatures make the stabilized frequency insensitive to output power. Author (ESA)

N82-23526*# RCA Labs., Princeton, N. J. Solid State Devices Lab.

STUDIES OF SINGLE-MODE INJECTION LASERS AND OF QUATERNARY MATERIALS. VOLUME 1: SINGLE-MODE CONSTRICTED DOUBLE-HETEROJUNCTION AlGaAs DIODE LASERS Final Report, 4 Feb. 1980 - 15 May 1981

Dan Botez Washington NASA Apr. 1982 70 p refs 2 Vol.

(Contract NAS1-15440)

(NASA-CR-3520; NAS 1.26:3520; PRRL-81-CR-29-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 20E

Constricted double-heterojunction (CDH) lasers are presented as the class of single-mode nonplanar-substrate devices for which the lasing cavity is on the least resistive electrical path between the contact and the substrate. Various types of CDH structures are considered under three general topics: liquid-phase epitaxy over channeled substrates, lateral mode control, and current control in nonplanar-substrate devices. Ridge-guide CDH lasers have positive-index lateral-mode confinement and provide: single-mode CW operation to 7 mW/facet at room temperature and to 3 mW/facet at 150 C; light-current characteristics with second-harmonic distortion as low as -57 dB below the fundamental level; threshold-current temperature coefficients, as high as 375 C (pulsed) and 310 C (CW); constant external differential quantum efficiency to 100 C; and lasing operation to 170 C CW and 280 C pulsed. Semileakyguide CDH lasers have an asymmetric leaky cavity for lateral-mode confinement and provide single-mode operation to 15 to 20 mW/facet CW and to 50 mW/facet at 50% duty cycle. Modulation characteristics and preliminary reliability data are discussed. Author

N82-23527*# RCA Labs., Princeton, N. J. Solid State Devices Lab.

STUDIES OF SINGLE-MODE INJECTION LASERS AND OF QUATERNARY MATERIALS. VOLUME 2: MEASUREMENT OF ELECTRO-OPTIC EFFECTS IN InGaAsP JUNCTION WAVEGUIDES Final Report, 4 Feb. 1980 - 15 May 1981

Jacob M. Hammer Washington NASA Apr. 1982 30 p refs 2 Vol.

(Contract NAS1-15440)

(NASA-CR-3521; NAS 1.26:3521; PRRL-81-CR-29-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 20E

Both the linear electro-optic (Pockel's) effect and electro-absorption (Franz-Keldysh effect) in waveguiding junctions of InGaAsP were measured. The electro-optic coefficient is found to be 0.1-0.14x10 to the -12 power m/V at lambda = 1.54 - 1 65 micrometers. Possibly this is the first reported measurement of the electro-optic coefficient for InGaAsP. The value found for the electroabsorption is on the order of 7x10 to the -4 power cm to the -1 power/(V/cm) or approximately 100 cm/1 for fields of 200,000 V/cm at lambda 1.3 micrometers. All measurements were made on a quaternary film with a bandgap wavelength of 1.23 micrometers. Because of the rapid commercial introduction of quaternary lasers, LEDs, and detectors to take advantage of large optical fiber bandwidths and low losses in the 1.2- to 1.7- micrometer region, these measurements are significant in providing some of the basic physical constants needed to design modulators and switches capable of operating at microwave frequencies in this wavelength region. A.R.H.

N82-23528# Los Alamos Scientific Lab., N. Mex.

LASER-INDUCED FLUORESCENCE TECHNIQUE TO MONITOR H2S (PR 16023) Quarterly Technical Progress Report, 1 Aug. - 31 Oct. 1981

2 Nov. 1981 6 p

(Contract W-7405-eng-36)

(DE82-002451; DOE/TIC-2002451) Avail: NTIS HC A02/MF A01

A means for detecting H2S at the 0.1 ppM level via laser induced fluorescence (LIF) was investigated. Because the upper electronic states of H2S are repulsive, it is necessary to use a two laser pump probe technique. The first laser (ArF, 193 nm) photodissociates H2S into HS and H. Subsequently, a probe dye laser is used to pump the HS ground state radicals to the state from which the radicals then fluoresce. This fluorescence signal can be related back to the H2S concentration prior to dissociation and thus affords a real time diagnostic for the species of interest. The quenching rate constants for DS (A state) quenching have been measured for the major constituents present in a gasifier. These data permit us to predict the fate of HS quenching. The quenching rate constants for HS cannot be measured directly. A correlation of the HS fluorescence signal with H2S concentration was made. DOE

N82-23529# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilungo Kreiselgeraete und Traegheitsortung.

RESONATOR STABILIZATION, DATA ACQUISITION AND COMPUTING A LASER GYRO Final Report

Gerald Siol Apr. 1981 78 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-754)

(Contract BWB-E/F-51-E/90001/85484)

(DFVLR-Mitt-81-15) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 17,50

In order to make the resonator length of the laser gyro insensitive to thermal or mechanical perturbations, a control loop, consisting of piezodrive, optical sensors, readout electronics, and phase sensitive demodulation was developed. The problems encountered, assembly, and the circuit components are described. Test results indicate excellent perturbation suppression for frequencies below 1 Hz. The acquisition system for the data of the stabilized gyro is described. It consists of a multichannel analyzer, floppy disk unit, and controller. The various programs for the data processing in FORTRAN, BASIC and Assembler are

given. The system is shown to be particularly useful for large data series and day-to-day measurements. Author (ESA)

N82-23530# Research Inst. of National Defence, Linkoeping (Sweden).
MEASURING SYSTEM FOR LASER SPECKLE STUDIES [MAETSYSTEM FOER LASERFLAECKSTUDIER]
Sune Johansson and Bengt Carlsson Dec. 1981 28 p In SWEDISH
(FOA-C-30249-E4) Avail: NTIS HC A03/MF A01

A system for studying intensity fluctuations in a laser pulse, after passage through a diverging lens, with 12 sensors placed on a rotating arm at a distance of 45 m, the arm covering a surface of 2 m diameter is described. The possibility of using laser speckle intensity determination for measuring the transmission properties of aerosols is mentioned. Results show that at 1060 nm wavelength, a laser can generate stable pulsed radiation over a surface of several square meters at a distance of 45 m, but at longer distances, as for studying aerosols, there is a risk of instability. Author (ESA)

N82-23531# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinst.
PRODUCTION OF SUBMICROSCOPIC GRATINGS BY THE USE OF LASER BEAM INTERFERENCE [HERSTELLUNG VON SUBMIKROSKOPISCHEN GITTERN MIT HILFE VON LASERSTRAHL-INTERFERENZ]
Rudolf Aulbach Aug. 1981 22 p refs In GERMAN; ENGLISH summary
(FTZ-FI-41-TBr-25) Avail: NTIS HC A02/MF A01

Periodic microstructures (submicroscopic gratings) were etched on the polished surface layer of a single crystal semiconductor chip. The required photomask was produced by laser beam interference. The argon ion laser and mirror configuration is described along with the grating production process. Results are related to the technological potential and limits of this process in manufacturing opto-electronic devices for optical communication, processing, and transmission systems. Author (ESA)

N82-23532# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kreiselgeraete und Traegheitsortung.
BACKSCATTERING OF LASER MIRRORS Final Report
Hans Bentlage Jun. 1981 31 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-756)
(Contract BWB-E/F-51-E/90001/85484)
(DFVLR-FB-81-25; ESA-TT-756) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 13,70

A measuring device is described which allows the determination of mirror backscattering responsible for the lock-in effect in laser gyros. Results of backscatter measurements as a function of the angle of incidence, of the local positions on the mirror surface, and of the polarization states of the light beam are presented and discussed. Measurements show that silver mirrors with supplementary dielectric layers of sufficient reflectivity have the least backscattering of all mirrors studied. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N82-23533# Mueller Associates, Inc., Baltimore, Md.
A FLEET MANAGER'S GUIDE TO VEHICLES FOR VALID RESULTS
Feb. 1981 39 p refs Presented at DOE Conf. on Fleet Use of Unique Automotive Fuels, San Antonio, Tex., 13-14 Aug. 1980 Sponsored by DOE
(DOE/CS-56051/04) Avail: NTIS HC A03/MF A01

While the measurement of acquisition, maintenance, and insurance costs is relatively straightforward and amenable to standard cost accounting procedures, the measurement and extrapolation of fuel use (and costs) from limited test programs involves many subtleties which, if ignored, can lead to erroneous conclusions. Information is presented to aid the automotive fleet manager in setting up a test program to measure and estimate fleet fuel economy and fuel use. Other areas of economic interest may also be added. The collection and analysis of data from various tests, and methos for reporting results and performing life cycle cost analyses are included. A.R.H.

N82-23534# Defence Research Information Centre, Orpington (England).
HYDRAULIC TRANSMISSIONS FOR VEHICLES WILL OPERATE AT VERY HIGH PRESSURES
J. Faisandier Nov. 1981 16 p Transl. into ENGLISH from Fluid - Apparecchiature Idrauliche e Pneumatiche (Italy), no. 198, 1980 p 63-68
(DRIC-T-6496; BR81973) Copyright. Avail: NTIS HC A02/MF A01

The limitations of current applications of hydraulic transmissions are considered theoretically. Masses of transmission elements (shaft, cylinder skirt, heads, oil), mass per unit of work per cycle, and mass in relation to power were calculated. It is shown that by optimizing the pressure, the efficiency of the hydraulic transmission can be made competitive with mechanical transmissions. Hydraulic transmissions made up of a variable displacement pump, two lines and a constant displacement engine are considerably influenced by developments towards high pressure. The increase in pressure and speed of rotation is directly translated into a reduction in mass and overall dimensions, with a corresponding decrease in costs. Author (ESA)

N82-23535# Medearis (Kenneth) Associates, Fort Collins, Colo.
DYNAMICS OF LOW-TUNED TURBINE GENERATOR FOUNDATION SYSTEMS Final Report
Kenneth Medearis Nov. 1981 83 p refs Sponsored by EPRI (EPRI Proj. 984-2)
(DE82-900856; EPRI-CS-2111) Avail: NTIS HC A05/MF A01

The dynamic performance of two turbine generator foundation systems, one low-tuned and the other high-tuned was studied. The aim was to provide a basis for possible further use of low-tuned foundations rather than the massive high-tuned systems that usually are constructed. Computerized models were developed to evaluate the dynamic responses of the two foundations. Parametric studies showed the effects of different analytic models, various model values, and unbalanced loadings. Both constant (2 and 5%) and frequency dependent damping values were considered. Modal studies included both the combined resultant effects of all modes and effects of vertically dominant modes. Vibration spectra and amplitudes were measured during steady operation. Analysis showed that both foundations are actually low-tuned, with similar frequency and amplitude-distribution responses. The first response (lowest-frequency) peak nearly always had the greatest amplitude, suggesting that damping increases with frequency. Dynamic performance of the low-tuned system was comparable or superior to the high-tuned foundation performance. All T-G foundations are believed to be actually low-tuned, irrespective of design goals. DOE

N82-23536# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Stroemung und Verbrennung.
A CONSTRUCTION FOR THE SIMULATION OF DIESEL MOTOR EVAPORATION AND COMBUSTION PROCESSES
Klaus Baeumer (Kloeckner-Humboldt-Deutz AG), Johannes Hartje, Jochen Mueller, Dieter Schlundt (Kloeckner-Humboldt-Deutz AG), Kurt Wanders, and Herbert Wiegand Feb. 1981 58 p refs In GERMAN; ENGLISH summary
(DFVLR-Mitt-81-27) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 14,70

A test stand was erected for the simulation of diesel engine fuel-air mixing, with the possibility of separately varying injection and air parameters. The flow mechanical design of the components of the construction is presented. Tests of the injection equipment design, measurement techniques, and start up of the equipment are discussed. In the mixing channel, approximately simulating the compression end of a diesel engine, the conditions can be adjusted as to pressure and temperature. The mixing process is theoretically interpreted and recorded with high speed photography and cinematography. Author (ESA)

N82-23537# Bornemann (J. H.) G.m.b.H. und Co. K.G., Obernikirchen (West Germany). Mashinenfabrik-Pumpenbau.
DEVELOPMENT OF NONPULSATING SCREW PUMPS WITH BETTER THAN AVERAGE EFFICIENCY FOR PRESSURES UP TO 100 BAR, SUITABLE FOR SEAWATER DESALINATION REVERSE OSMOSIS INSTALLATIONS Final Report, May 1981
Gerhard Bardewyck Bonn Bundesministerium fuer Forschung und Technologie Dec. 1981 65 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-M-81-006; ISSN-0340-8868) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.90

Pump screw profiles were geometrically optimized in order to reduce the flank gap to a minimum, while achieving a minimum casing gap through use of screw shafts with slide bearings in the zone of greatest bending. Pumps of this construction were then developed for higher operating speeds so as to considerably increase efficiency. An operating pressure of 100 bar is achieved. The required operating conditions for a high pressure, eccentric helical rotor pump are almost realized; this pump is presently being used in a desalination facility.
Author (ESA)

N82-23538# Technische Hochschule, Aachen (West Germany). Inst. fuer Kraftfahrwesen.
PERIPHERAL COMPRESSOR FOR SEWAGE CLARIFICATION PLANTS Final Report
Andreas Bender Bonn Bundesministerium fuer Forschung und Technologie Dec. 1981 121 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-217; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25.60

The efficiency of the peripheral compressors for sewage purification plants was increased in order to reach cost advantage for the whole operation period and a further noise reduction as compared to roots compressors. For the air injection in purification plants today mostly roots compressors are used, which have to be installed in seperate engine rooms to reduce the noise emission and to enable the maintenance work. With the application of peripheral compressors this expense can be reduced, because these maintenance free compressors are able to work under the water surface, the sound absorbing effect of the water can be used, and there is no need for engine rooms and surface pipes. In the present development stage peripheral compressors have a lower efficiency than the roots compressors. By means of flow optimization in the blades and air inlet the performance and efficiency of this compressor was doubled in comparison with standard peripheral compressors. The sound emission was significantly reduced by improving the sound absorbers. These advanced compressors are efficient instruments in sewage purification plants.
Author (ESA)

N82-23539# Columbia Univ., New York.
THE ANALYTIC DEVELOPMENT AND EXPERIMENTAL VERIFICATION OF A PREDICTIVE MODEL OF A HIGH-SPEED CAM-FOLLOWER SYSTEM Ph.D. Thesis
Albert P. Pisano 1981 290 p
Avail: Univ. Microfilms Order No. 8125369

The development and verification of an accurate, predictive, dynamic model of a high speed cam-follower system is discussed. Basic measurements were made on a current automotive cam-follower system (valve train). The dynamic response of the cam-follower system was measured with a high-speed, computer-controlled data acquisition system. Quantities sampled include position and velocity of the output mass (engine value), reaction force of the return spring (valve spring), and actuating force applied by the cam (pushrod load). The experimental test stand and much of the instrumentation were custom designed. With the aid of the experimental data, an accurate predictive computer model of the cam-follower system was formulated and verified. This dynamic model contains both bumped parameter and distributed parameter representations of machine elements.
Dissert. Abstr.

N82-23349*# General Electric Co., Philadelphia, Pa. Space Systems Operations Dept.
DEVELOPMENT OF AN ULTRA-LOW-SHOCK SEPARATION NUT
William Woebkenberg, Donald N. Matteo, and Vaughn D. Williams (Hi-Shear Corp., Torrance, Calif.) *In* NASA. Kennedy Space Center Center The 16th Aerospace Mech. Symp. May 1982 p 87-98 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23350*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Mechanisms and Separation Analysis Group.
A BALL TRUNNION CAPTURE LATCH
David V. Adams and Brendan Alchorn *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 99-107 ref (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23351*# Hughes Aircraft Co., El Segundo, Calif. Space Sensors Div.
A MOVABLE STOP MECHANISM FOR THE SIRE TELESCOPE
R. E. Tweedt and Robert N. Poulsen *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 109-121 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23352*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DUAL DRIVE ACTUATORS
Douglas T. Packard *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 123-141 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23353*# Societe Europeenne de Propulsion, Vernon (France).
DESIGN ASPECTS OF A SOLAR ARRAY DRIVE FOR SPOT, WITH A HIGH PLATFORM STABILITY OBJECTIVE
Jacques Cabillic, J. P. Fournier, P. Anstett, M. Souliac, and G. Thomin (CNES) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1981 p 143-157 Prepared in cooperation with MATRA (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23354*# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
DEVELOPMENT OF A HIGH STABILITY POINTING MECHANISM FOR WIDE APPLICATION
A. J. D. Brunnen and R. H. Bentall (European Space Agency) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 159-173 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23355*# Aerospace Corp., Los Angeles, Calif. Vehicle Engineering Div.
COMPUTER-AIDED DESIGN AND ANALYSIS OF MECHANISMS
Frank L. Knight *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 175-188 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23356*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Systems Engineering Dept.
ESTIMATION OF BEARING CONTACT ANGLE IN-SITU BY X-RAY KINEMATOGRAPHY
Peter H. Fowler and Frank Manders (Ball Aerospace Systems) *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 189-199 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23358*# Ford Aerospace and Communications Corp., Palo Alto, Calif. Systems Analysis Dept.
DESIGN AND ANALYSIS CONSIDERATIONS FOR DEPLOY-

MENT MECHANISMS IN A SPACE ENVIRONMENT
P. L. Vorlicek, J. V. Gore, and C. T. Plescia *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 211-222 Sponsored in part by INTELSAT (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23359*# British Aerospace Dynamics Group, Bristol (England).
A DEPLOYMENT MECHANISM FOR THE DOUBLE ROLL-OUT FLEXIBLE SOLAR ARRAY ON THE SPACE TELESCOPE
T. R. Cawsey *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 223-233 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23360*# Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.
SOLAR DRUM POSITIONER MECHANISMS
L. W. Briggs *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 235-247 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N82-23367*# British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
DESIGN OF A 7kW POWER TRANSFER SOLAR ARRAY DRIVE MECHANISM
J. G. Sheppard *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 341-350 refs (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N82-23540# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
DEVELOPMENT OF A FINITE-ELEMENT MODEL FOR EDDY-CURRENT NDT PHENOMENA Interim Report
W. Lord Sep. 1981 112 p refs Sponsored by EPRI (DE82-900364; EPRI-NP-2026) Avail: NTIS HC A06/MF A01

One major factor limiting progress towards development of a viable defect characterization scheme for eddy current testing is the lack of a general mathematical model capable of predicting the complex electromagnetic field/defect interactions in the part under test. The feasibility of applying finite element numerical techniques to the problem of modeling eddy current NDT phenomena was determined. Results of finite element studies are given for numerous eddy current testing geometries including coils and conductors above conducting planes for which analytical results exist and, complex steam generator tubing problems which to date have not been solved analytically. The finite element results are compared with experimental data and analytical data. DOE

N82-23541# Technical Research Centre of Finland, Espoo. Metallilab.
NONDESTRUCTIVE TESTING: RELIABILITY OF ULTRASONIC AND RADIOGRAPHIC INSPECTION
Matti Aaltio 1981 115 p refs In FINNISH; ENGLISH summary
(VTT-RN-14/81; ISBN-951-38-1252-9; ISSN-0358-5085) Avail: NTIS HC A06/MF A01

Radiographic and ultrasonic nondestructive inspection methodologies for welded joints were compared. The reliability of defect detection on different test specimen geometries was evaluated. Butt joints on metal plates and pipes were examined. Conformity of internal weld defects, classified routinely by experienced inspectors, was checked against results from visual examination of sectioned welds. Although overall effectiveness of nondestructive inspection is satisfactory, marked departure from correct fault classification by X-ray analysis is noted. This points to application factors which influence test performance. Author (ESA)

N82-23542# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
COMPARISON OF RELIABILITY, SENSITIVITY AND ACCURACY OF SOME NDI-TECHNIQUES
E. A. B. deGraaf and P. deRijk Oct. 1980 32 p refs In DUTCH; ENGLISH summary Presented at Dutch Soc. for Non-Destructive Testing Lecture Series, 4 Nov. 1980
(NLR-MP-80039-U) Avail: NTIS HC A03/MF A01

Reliability, sensitivity and accuracy of some nondestructive inspection (NDI) methods were investigated and compared. Reliability, sensitivity and accuracy of nondestructive inspection are defined. The restrictions on reusing NDI reliability specimens are described. Inspection results obtained with fluorescent and red penetrants are compared. Reliability, sensitivity and accuracy of a number of the most popular NDI methods, as applied to aluminum specimens and rejected steel aircraft landing gear components are treated. Three investigations are briefly depicted. Spreading in NDI results is substantial. Corrosion deteriorates reliability, sensitivity and accuracy. Red penetrant is much worse than fluorescent penetrant. Fluorescent penetrant inspection results strongly depend on the specimen configuration and vary from very good to moderate. Eddy current method gives good results. Magnetic inspection is advisable wherever it can be applied. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N82-23543# Rensselaer Polytechnic Inst., Troy, N. Y.
KINEMATIC ELASTO-DYNAMIC ANALYSIS AND COMPUTER GRAPHICS SIMULATION OF GENERAL PURPOSE ROBOT MANIPULATORS Ph.D. Thesis
Stephen James Derby 1981 185 p
Copyright. Avail: Univ. Microfilms Order No. 8200458

A general purpose computer program was developed that enables a designer to evaluate the performance of robot arms in potential working environments. A vector refresh graphics terminal displays the wire frame image of the manipulator, its hand, and the primitives describing the workspace. The resulting animation in simulated time will provide a proper base for designing new manipulators, for modifying existing designs, and for the logical layout of any machines the robot may interact with. The development of the computer program incorporates not only the joint and hand displacement, velocity and acceleration analyses, it also includes compensation for deflection of the aim from a prescribed path due to inertia and gravity effects. Further, the program incorporates an analysis for the external reach of the robot's hand which enables the user to plot the associated envelope that encloses the reachable volume. Initially, the different methods available for analyzing the joint variables of manipulators are discussed and compared, and several popular general cases are solved. Dissert. Abstr.

N82-23544# Rensselaer Polytechnic Inst., Troy, N. Y.
CYLINDRICALLY ORTHOTROPIC CIRCULAR PLATES WITH A CONCENTRIC HOLE AND WITH PROPERTIES VARYING RADIALLY Ph.D. Thesis
Christoph Muser 1981 158 p
Avail: Univ. Microfilms Order No. 8200468

A finite circular plate, cylindrically orthotropic in its elastic properties, was subjected to uniform uniaxial tension. There was a circular hole at the center of the plate which was also the origin of the system of coordinates used. The material properties vary with distance from the center and through an appropriate variation it is possible to achieve low values of the stress

concentration at the edge of the hole. Solutions are obtained for the distribution of the stresses and, in particular, for the stress concentrations. The method used is analytical and it involves Airy stress functions and infinite power series. (A state of plane stress is assumed.) Usually not more than fifteen terms are needed to obtain results of satisfactory accuracy. Conditions for absolute convergence are given. Ways to manufacture plates with the reinforced plastics having the properties described are presented. The analytical results show that it is possible to reduce the stresses at the edge of the hole to zero or even to negative values. Dissert. Abstr.

N82-23545# California Univ., Berkeley.
A RESTRICTED THEORY OF SHELLS WITH MODERATE ROTATION Ph.D. Thesis
Lerkiat Vongsarnpigoon 1981 164 p
Avail: Univ. Microfilms Order No. 8200297

Several aspects of a contrained theory of shells, constructed by a direct approach via a two dimensional continuum model called a Cosserat surface C are investigated. The Cosserat surface C comprises a two dimensional surface embedded in a three dimensional Euclidean space, together with a vector field called a director assigned to every point of the surface of C; the director has the property that its length remains unaltered under superposed rigid body motions. Also, in the constrained theory, the director is contrained to remain always along the normals of the surface. In the context of the above contrained theory, detailed analysis is undertaken for the development of the kinematics and the construction of constitutive equations of an elastic shell in which the strain in the surface is small but may be accompanied by finite or by moderately large rotation. After summarizing the basic equations of a Cosserat surface, differential equations are derived for the determination of the deformation gradient and the rotation tensor and, further, the integrability conditions are shown to reduce to the usual Mainardi-Codazzi equations and the equations of Gauss. Dissert. Abstr.

N82-23546# Minnesota Univ., Minneapolis.
NUMERICAL MODELING OF WIND LOADS IN STRUCTURES Ph.D. Thesis
Dipak Shantilal Kamdar 1981 314 p
Avail: Univ. Microfilms Order No. 8125976

The finite element method is applied to steady state fluid flow around structures; such flow being governed by the Navier-Stokes equations. Two dimensional, incompressible, laminar fluid flows are investigated. The Navier-Stokes equations are represented by the stream and vorticity functions. A variational formulation is used to derive the element equations. Three, six and nine degrees of freedom (dof) triangular elements are developed and tested numerically. Potential flow around a circular cylinder is modelled, and the results obtained are compared with closed form analytic solution. Four different finite element models are used to check the accuracy of the solution procedure and the discretization error. The pressure field is computed by a finite element formulation using 3 dof elements. Once a satisfactory solution procedure had been achieved, the problem of potential flow around rectangular building structures with width to depth ratio of 1:1, 2:1 and 4:1 is investigated. Dissert. Abstr.

N82-23547# Illinois Univ. at Urbana-Champaign.
SOLUTION TECHNIQUES FOR LARGE EIGENVALUE PROBLEMS IN STRUCTURAL DYNAMICS Ph.D. Thesis
In-Won Lee 1981 109 p
Avail: Univ. Microfilms Order No. 8127629

The determination of eigenvalues and eigenvectors of large algebraic systems is discussed. In particular, the methods developed are applicable to finding the natural frequencies and modes of vibration of large structural systems such as frames or continuous systems discretized in some way. For distinct eigenvalues the method is an application of the modified Newton-Raphson method that turns out to be mode efficient than the standard competing schemes. For close or multiple eigenvalues, the modified Newton-Raphson method is generalized to form an altogether new process. The entire set of close eigenvalues and their eigenvectors are found at the same time in a two-step procedure. The subspace of the approximate eigenvectors is first projected onto the subspace of the true eigenvectors. This part of the technique is rapid and efficient. If the eigenvalues are multiple, the results of the first stage indicate this fact and no further calculation is needed. If they are merely close, a single rotation in the newly found space solves the small eigenvalue problem and provides the final eigenvectors and eigenvalues of the close set. Dissert. Abstr.

N82-23548# Illinois Univ. at Urbana-Champaign.
RESPONSE OF REINFORCED CONCRETE PLATE-COLUMN CONNECTIONS TO DYNAMIC AND STATIC HORIZONTAL LOADS Ph.D. Thesis
Denby Grey Morrison 1981 590 p
Avail: Univ. Microfilms Order No. 8127650

The response of interior reinforced concrete plate-column connections was studied. Eight specimens were tested, statically and dynamically (rate of loading significant). Other experimental variables were reinforcement ratio and the amount of superimposed vertical load. The specimens had certain common characteristics. Nominal slab dimensions were 1.8 by 1.8 m; slab thickness was 76 mm. The column was square with dimensions of 0.3 by 0.3 m. The reinforcement layout in the slab was isotropic. The statically tested specimens provided information on the influence of the change in reinforcement ratio and the amount of superimposed vertical load on the response to horizontal loading. An analysis model (the grid model) was developed to help interpret the results from the statically tested specimens. The dynamically tested specimens were used to obtain data on the response of the specimens, the observed hysteresis and calculated damping. Dissert. Abstr.

N82-23549*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A TWO-DEGREE-OF-FREEDOM FLUTTER MOUNT SYSTEM WITH LOW DAMPING FOR TESTING RIGID WINGS AT DIFFERENT ANGLES OF ATTACK
Moses G. Farmer Apr. 1982 20 p refs Presented at Va. Academy of Sci. Meeting, Blacksburg, Va., 20-23 Apr. 1982 (NASA-TM-83302; NAS 1.15:83302) Avail: NTIS HC A02/MF A01 CSCL 14B

A wind tunnel model mount system for conducting flutter research using a rigid wing was developed. The wing is attached to a splitter plate so that the two move as one rigid body. The splitter plate is supported away from the tunnel wall by a system of rods with fixed fixed and conditions. The rods flex in such a way that only pitch and plunge oscillations are permitted. At the tunnel wall the rods are attached to a remotely controlled turntable so that angle of attack can be varied. Wind tunnel data obtained by using the mount system are presented for a supercritical and a conventional airfoil. Both classical flutter and stall flutter data are presented. S.L.

N82-23550*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
IMPLEMENTATION OF STRUCTURAL RESPONSE SENSITIVITY CALCULATIONS IN A LARGE-SCALE FINITE-ELEMENT ANALYSIS SYSTEM
Gary L. Giles and James L. Rogers, Jr. Mar. 1982 14 p refs Presented at the AIAA/ASME/ASCH/AHS Struct., Structural Dyn. and Mater. Conf., New Orleans, 10-12 May 1982 (NASA-TM-83293; NAS 1.15:83293; AIAA-PAPER-82-0714) Avail: NTIS HC A02/MF A01 CSCL 20K

The implementation includes a generalized method for specifying element cross-sectional dimensions as design variables that can be used in analytically calculating derivatives of output quantities from static stress, vibration, and buckling analyses for both membrane and bending elements. Limited sample results for static displacements and stresses are presented to indicate the advantages of analytically calclating response derivatives compared to finite difference methods. Continuing developments to implement these procedures into an enhanced version of the system are also discussed. T.M.

N82-23551# Aeronautical Research Labs., Melbourne (Australia).
CRACK CLOSURE AND CRACK GROWTH RATE: AN EMPIRICAL MODEL TO ACCOUNT FOR R
G. S. Jost and L. R. Gratzer Aug. 1981 34 p refs (ARL/Struc-Rept-387; AR-002-311) Avail: NTIS HC A03/MF A01

An empirical equation is proposed to account for stress ratio

effects in fatigue crack growth based upon the crack closure concept. It is characterized by two fitted parameters. The equation is used to establish effective stress intensity ranges for three sets of extensive crack growth rate data from the literature covering the stress ratio range -1 < or = 1 least squares best fitted Paris equations are then used to predict crack growth lives for comparison with the individual originals. Actual lives are almost invariably within the range from 1/3 to 2 times those predicted. It is shown that even better fits to the data would result from using a sigmoidal growth rate/effective stress intensity range relationship. Author

N82-23552*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN EXACT PLANE-STRESS SOLUTION FOR A CLASS OF PROBLEMS IN ORTHOTROPIC ELASTICITY Interim Report
David A. Erb (Freightliner Corp.), Paul A. Cooper, and Terrence A. Weisshaar (Purdue Univ., Indiana) Feb. 1982 74 p refs (Contract NCC-1-15)
(NASA-TM-84736; NAS 1.15:84736; VPI-E-82-3; IR-26) Avail: NTIS HC A04/MF A01 CSCL 20K

An exact solution for the stress field within a rectangular slab of orthotropic material is found using a two dimensional Fourier series formulation. The material is required to be in plane stress, with general stress boundary conditions, and the principle axes of the material must be parallel to the sides of the rectangle. Two load cases similar to those encountered in materials testing are investigated using the solution. The solution method has potential uses in stress analysis of composite structures. S.L.

N82-23553*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ON THE OFF-AXIS TENSILE TEST FOR UNIDIRECTIONAL COMPOSITES Interim Report
Michael P. Nemeth, C. T. Herakovich, and D. Post Apr. 1982 30 p refs
(Contract NCC1-15; Grant NSF ENG-78-24609)
(NASA-CR-168853; NAS 1.26:168853; VPI-E-82-9; IR-20) Avail: NTIS HC A03/MF A01 CSCL 20K

The off axis tensile test was examined experimentally to obtain actual displacement fields over the surface of graphite polyimide coupon specimens. The experimental results were compared with approximate analytical solutions and generated finite element results. An optical method of high sensitivity moire interferometry was used to determine the actual displacements to high precision. The approximate analytical solution and the finite element results compare very favorably with the measured centerline displacements in the test section, and the finite element displacement fields provide excellent agreement with the moire displacements throughout the specimen. A 15 degree fiber orientation and coupon aspect ratios of 5 and 15 are presented. S.L.

N82-23554*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Engineering Science and Mechanics.
INFLUENCE OF LAYER THICKNESS ON THE STRENGTH OF ANGLE-PLY LAMINATES
Carl T. Herakovich Apr. 1982 30 p refs
(Contract NCC1-15)
(NASA-CR-168892; NAS 1.26:168892; VPI-E-82-10) Avail: NTIS HC A03/MF A01 CSCL 20K

Experimental results are presented showing that the strength and toughness of finite width angle-ply laminates can be increased significantly by using an alternating layer stacking sequence as opposed to a clustered configuration. The ultimate tensile stress of an alternating plus/minus theta laminate of the form [(+ or - theta) sub 2] sub s can be much as 1.5 times that of a clustered configuration of the form [theta sub 2/-theta sub 2] sub s. Further, the toughness of the alternating layer configuration can be as much as 2.7 times that of the clustered configuration. These differences are explained analytically through consideration of the influence of layer thickness on the magnitude of the interlaminar shear stress and by examination of failed specimens. It is shown that the two laminate configurations exhibit distinctly different failure modes for some fiber angles. Both laminate configurations exhibit catastrophic failure with the damage limited essentially to a small region defined by the length of a single crack across the width of the specimen, parallel to the fiber direction. Results are presented for T300/5208 graphite-epoxy for fiber orientations of 10, 30, and 45 deg.M.G.

N82-23555# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Dept. des Etudes Mecaniques et Thermiques.
SURVEY OF EXPERIMENTAL TESTS ABOUT PROGRESSIVE DISTORTION
Gerard Clement Feb. 1981 49 p refs In FRENCH
(CEA-N-2184) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

A procedure for evaluation of progressive distortion experimental data was established in CEA. This procedure based on the effective primary stress concept, permits the establishment of a simple design rule. Various published experimental data were used for verification, validation, and generalization of design rule proposed. This rule is compared with existing codified rules. DOE

N82-23556# Pennsylvania State Univ., University Park.
REVIEW AND EVALUATION OF NONDESTRUCTIVE METHODS FOR RESIDUAL-STRESS MEASUREMENT Final Report
C. O. Ruud Sep. 1981 105 p refs
(EPRI Proj. 1395-5)
(DE82-900373; EPRI-NP-1971) Avail: NTIS HC A06/MF A01

The role of residual stresses in the failure of structural components through stress corrosion, fatigue, premature fracture etc. is receiving increased attention. In order to economically supply the residual stress information on complex structures, nondestructive methods of measurement are required. The state of the art of nondestructive residual stress measurement methods, applications and limitations, a prognosis for possible development and application, and recommendation for technical areas in which research would be most effective are discussed. It is found that the X-ray diffraction techniques are the only truly nondestructive methods for which the technology is sufficiently developed for field application. It is concluded that the ultrasonic techniques hold the greatest promise for the future. DOE

N82-23557# Bundesanstalt fuer Materialpruefung, Berlin (West Germany).
INVESTIGATIONS OF THE EFFECTS OF THE STATE OF STRESS ON FRACTURE CHARACTERISTICS
P. Schmidt, Dietmar Aurich, Rolf Helms, Helmut Veith, and Josef Ziebs Feb. 1980 118 p refs In GERMAN; ENGLISH summary
(INIS-mf-6456; ISSN-0172-7613) Avail: NTIS (US Sales Only) HC A06/MF A01

Investigations were made to determine whether a biaxial load increases the stress state over the plain strain and whether a decrease of the critical fracture toughness and shift of the temperatures Tsub(g)sub(y) and Tsub(s) have results which characterize the fracture behavior of steel. Tests were made which induced an additional nominal stress parallel to the crack front inspite of uni-axial loading. The results were compared with those from specimens without an additional nominal stress and having in their cross sections under the same test conditions, nearly the same plain strain. The fracture toughness of both specimen type's were compared at temperatures between 142 K and 252 K and correlated to other material-characterizing values. The tests were completed by stress analysis and by comparing the crack opening displacement. Due to the additional stress, Tsub(g)sub(y) was found to be 20 K higher than for the reference specimen. The fracture toughness decreased significantly in certain temperature ranges. The plastic stress concentration factor was comparatively higher and the remaining plastic crack opening decreased up to 25%. DOE

N82-23558# National Engineering Lab., East Kilbride (Scotland). Service Loading Div.
ADDITIONAL FATIGUE CRACK GROWTH THRESHOLDS
A. F. Greenan Jan. 1982 25 p refs Sponsored by UK Dept. of Industry's Engineering Materials Requirement Board
(NEL-679) Avail: NTIS HC A3/MF A01

The fatigue crack growth threshold (delta K sub Ith) for steels, nickel, brass, 4 1/2% Cu-Al alloy and gray cast iron was

determined in standard tests. The effect of immersion in 3% w/w NaCl on delta K sub Ith was studied. Results confirm literature predictions except for commercially pure nickel, where lower values are obtained. The coarser the grain size, the higher the value of delta K. In 3% w/w NaCl, the threshold is reduced by 40% in an 18/8 austenitic steel, 60% in a maraged steel, and 33% in the 4% Cu-Al alloy. The gray cast iron delta K sub Ith value is significantly lower than previous values for edge cracked test pieces. Author (ESA)

N82-23559# Oxford Univ. (England). Dept. of Engineering Science.

PANEL LOADING MEAN PRESSURE STUDY FOR CANOPY ROOFS

S. J. Gumley 1981 96 p refs Sponsored by UK Building Research Estab., Ministry of Agriculture, Fisheries and Food and Rhodes Scholarship Trustees

(OUEL-1380/81) Avail: NTIS HC A05/MF A01

The influence of stacking patterns under a typical barn-like canopy was investigated. Wind pressures on a wind tunnel model of a canopy roof were studied, with roof pitch angle, relative wind orientation, ground effect, geometric aspect ratio, and internal stacking arrangements under the open structures as parameters. Worst case envelopes for mean pressures averaged over whole and half roof areas, and for panel pressures were compiled. The envelopes were compared with conventional wind loading codes where peak pressure is the product of gust dynamic pressure and mean pressure coefficient. Test results differ greatly from code values. Codes underestimate: (1) suction loads on canopies of pitch angle > 8 deg; (2) mean roof-averaged pressures at angles of inclination of roof to flow > 16 deg; and (3) mean pressures on individual cladding panels for monoslope roof angles > 10 deg. Author (ESA)

N82-23560# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

A THEORETICAL STUDY OF THE IMPACT OF AIRCRAFT WAKE VORTICES ON ROOFS IN THE FINAL APPROACH AREA OF DUSSELDORF AIRPORT

Otto Weber and Rolf Ulken Dec. 1981 63 p refs In GERMAN; ENGLISH summary

(DFVLR-Mitt-82-01) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 21,50

Damage to buildings caused by the impact of trailing wake vortices shed from widebodied aircraft in the final approach area of Dusseldorf Airport was studied. Forty-two occurrences of roof damage were analyzed, using a simplified model for the strength, transport, and decay of wake vortices. The model is interpreted with reference to the results of a vortex allevation program carried out in the U.S. Wake vortex characteristics, maximum tangential velocity and vortex decay are discussed. Measurement of vortex far field reduction is considered. Other investigations of roof damage in the approach areas of Hamburg, Berlin (Tempelhof), and London (Heathrow) airports are summarized. The value of potential aircraft modifications and precautions on the ground are assessed, suggesting supplementary measurements on board aircraft and in buildings. Author (ESA)

N82-23561# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

SOME CASE STUDIES AND THE SIGNIFICANCE OF FATIGUE THRESHOLDS

R. J. H. Wanhill Apr. 1981 15 p refs Presented at Intern. Symp. on Fatigue Thresholds, Stockholm, Jun. 1981

(NLR-MP-81015-U) Avail: NTIS HC A02/MF A01

Examples of service failures, involving low-cycle and/or high-cycle fatigue, are described and discussed with respect to the significance of thresholds for high-cycle fatigue crack propagation. The examples are: aircraft undercarriage cylinders made of high strength 4340 steel; aircraft gas turbine compressor drive shafts made of A286 steel; and aircraft gas turbine blades made of Rene 80 nickel-base superalloy. The examples show that the importance of Delta K sub th is unlikely to be important for a particular service fatigue problem. Delta K sub th as a design criterion is restricted to safe crack growth components and structures whose anticipated service loads consist mainly or entirely of large numbers of low amplitude cycles and which are difficult or impossible to inspect in service. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N82-23562# Delaware Univ., Newark.

A RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF VERTICALLY INHOMOGENEOUS WATERS Ph.D. Thesis

William Douglas Philpot 1981 157 p

Avail: Univ. Microfilms Order No. 8128344

In remote sensing of water, it is regularly assumed that the water is vertically homogeneous over the effective depth of penetration of the remote instrument. It appears that this assumption is often valid given many successful applications of remote sensing using this assumption. Yet, there are conditions for which vertical inhomogeneities are both significant and detectable. In order to explore the sensitivity of remote observations to vertical inhomogeneities a mathematical model was developed which illustrates the qualitative aspects of the problem, and which, at the same time, gives reasonably accurate quantitative results. The model is relatively standard in its approach to describing the downwelling light field above the water surface, and the transmission and reflection of light at the air-water interface. Dissert. Abstr.

N82-23563*# Consiglio Nazionale delle Ricerche, Naples (Italy). Osservatorio Vesuviano.

CRUSTAL STRUCTURES UNDER THE ACTIVE VOLCANIC AREAS OF CENTRAL AND EASTERN MEDITERRANEAN (M-44) Progress Report

Paolo Gasparini, Principal Investigator, Marta S. M. Mantovani, Francesco Monaco, Donatella Pierattini, and Maurizio Fedi 10 Jan. 1981 4 p Sponsored by NASA ERTS

(E82-10096; NASA-CR-168845; NAS 1.26:168845) Avail: NTIS HC A02/MF A01 CSCL 08G

Programs are being adapted to the UNIVAC 1000 computer and others are being developed for immediate utilization in processing MAGSAT data. The magnetization intensity, susceptability, Koeningsberger ratio, NMR stbility against alternated fields and temperature, and the Curie temperature were determined for some rock formations with mineralogical compositions stable to the intermediate for lower continental crust and to upper manele conditions. Attempts to residuate crustal anomalies from one selected profile passing through western mediterranean using procedures commonly used at NASA yielded dubious results because of uncertainties in the adoption of coefficients in the expression accounting for the effect of equatorial ring currents and the empirical approach used for other corrections. Instead, filtering techniques are to be applied to each profile once invesigator B tapes relative to the whole planet are received.

A.R.H.

N82-23564*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A METEOROLOGICALLY DRIVEN MAIZE STRESS INDICATOR MODEL

T. W. Taylor and F. W. Ravet, Principal Investigators Apr. 1981 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)
(E82-10112; NASA-TM-84201; JSC-173991; NAS 1.15:84201; EW-UI-04119) Avail: NTIS HC A02/MF A01 CSCL 02C

A maize soil moisture and temperature stress model is described which was developed to serve as a meteorological data filter to alert commodity analysts to potential stress conditions in the major maize-producing areas of the world. The model also identifies optimum climatic conditions and planting/harvest problems associated with poor tractability. Author

N82-23565*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. THE 1980 US/CANADA WHEAT AND BARLEY EXPLORATORY EXPERIMENT
R. W. Payne, Principal Investigator Jul. 1981 30 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10126; NASA-CR-167404; JSC-17406; NAS 1.26:16740; LEMSCO-16921; FC-L1-04127) Avail: NTIS HC A03/MF A01 CSCL 02C

The crop identification procedures used performed were for spring small grains and are conducive to automation. The performance of the machine processing techniques shows a significant improvement over previously evaluated technology; however, the crop calendars require additional development and refinements prior to integration into automated area estimation technology. The integrated technology is capable of producing accurate and consistent spring small grains proportion estimates. Barley proportion estimation technology was not satisfactorily evaluated because LANDSAT sample segment data was not available for high density barley of primary importance in foreign regions and the low density segments examined were not judged to give indicative or unequvocal results. Generally, the spring small grains technology is ready for evaluation in a pilot experiment focusing on sensitivity analysis to a variety of agricultural and meteorological conditions representative of the global environment. Author

N82-23566*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
DIURNAL CHANGES IN REFLECTANCE FACTOR DUE TO SUN-ROW DIRECTION INTERACTIONS
M. E. Bauer, Principal Investigator, V. C. Vanderbilt, J. C. Kollenkark, L. L. Biehl, B. F. Robinson, and K. J. Ranson Sep. 1981 13 p refs Repr. from Intern. Colloq. on Spectral Signatures of Objects in Remote Sensing (France), 1980 Colloq. held in Avignon, France, 8-11 Sep. 1980 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10128; NASA-CR-167403; NAS 1.26:167403; LARS-090881; SR-P1-04140) Avail: NTIS HC A02/MF A01 CSCL 02C

Over a two year period, data were collected regarding the canopies of soybeans grown in rows in planter boxes placed on a turntable in an effort to investigate changes in the spectral reflectance factor related to row direction, Sun direction, soil background, and crop development stage. Results demonstrate that the direction of rows in a soybean canopy can affect the reflectance factor of the canopy by as much as 230%. The results for the red spectral region tend to support the validity of canopy reflectance models; results for the infrared region do not. A.R.H.

N82-23567*# Business and Technological Systems, Inc., Seabrook, Md.
EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Jan. - 31 Mar. 1981
31 Mar. 1981 4 p ERTS
(Contract NAS5-26047)
(E82-10151; NASA-CR-168536; NAS 1.26:168536; QR-5) Avail: NTIS HC A02/MF A01 CSCL 05B

Modeling and software development of the main field using MAGSAT data is discussed. The cause of the apparent bulge in the power spectrum of Dipole model no. 4 was investigated by simulation with POGO crustal anomaly field model. Results for cases with and without noise, and the spectra of selected reslts are given. It is indicated that the beginning of the bump in the spectrum of Dipole no. 4 is due to crustal influence, while the departure of the spectrum from that of MGST (12/80-2) around expansion order 17 is due to the resolution limits of the Dipole density. E.A.K.

N82-23568*# Environmental Research Inst. of Michigan, Ann Arbor.
LANDSAT TECHNOLOGY TRANSFER TO THE PRIVATE AND PUBLIC SECTORS THROUGH COMMUNITY COLLEGES AND OTHER LOCALLY AVAILABLE INSTITUTIONS Final Report, 20 Dec. 1979 - 20 Dec. 1980
Robert H. Rogers, Principal Investigator Dec. 1980 59 p ERTS
(Contract NASw-3308)
(E82-10181; NASA-CR-168846; NAS 1.26:168846; ERIM-147200-13-F) Avail: NTIS HC A04/MF A01 CSCL 05A

Major first year accomplishments are summarized and plans are provided for the next 12-month period for a program established by NASA with the Environmental Research Institute of Michigan to investigate methods of making LANDSAT technology readily available to a broader set of private sector firms through local community colleges. The program applies a network where the major participants are NASA, university or research institutes, community colleges, and obtain hands-on training in LANDSAT data analysis techniques, using a desk-top, interactive remote analysis station which communicates with a central computing facility via telephone line, and provides for generation of land cover maps and data products via remote command. A.R.H.

N82-23569*# Texas Univ. at El Paso.
CHARACTERIZATION OF THE STRUCTURE AND TECTONIC OF SOUTH AMERICA Quarterly Report, 1 Mar. - 30 Jun. 1981
G. R. Keller and E. G. Lidiak, Principal Investigators 30 Jun. 1981 4 p ERTS
(NAS5-26326)
(E82-10196; NASA-CR-168623; NAS 1.26:168623) Avail: NTIS HC A02/MF A01 CSCL 08G

Geologic studies of the South American plate were undertaken. The Guayana shield is reasonably well studied, and although data are sparce, the central Brazilian shield appears similar. Both the Amazon and Parnaiba basins seem to be related to an aulocogen structure. The collection of crustal structure information and the generation of measurement of surface wave dispersion in the shield areascontinues. Long period seismograms are digitized and analyzed. Exisiting crusted and upper mantle studies were indexed. Both MAGSAT scaler and vector magnetic anomaly data were used with regional gravity anomaly data to investigate the regional tectonic features of the South American plate. E.A.K.

N82-23570*# Analytic Sciences Corp., Reading, Mass.
[ANALYSES OF MAGSAT TRACKS CROSSING THE STUDY REGION IN THE INDIAN OCEAN] Quarterly Progress Report, 2 Dec. 1980 - 31 Mar. 1981
Richard V. Sailor and Andrew R. Lazarewicz, Principal Investigators 7 May 1981 15 p ERTS
(Contract NAS5-26424)
(E82-10197; NASA-CR-168624; NAS 1.26:168624; PR-1325-1) Avail: NTIS HC A02/MF A01 CSCL 05B

Progress in software development and in preliminary analysis of MAGSAT tracks crossing the Indian Ocean is reported. Tracks crossing the Java Trench, Broken Ridge, the Southeast Indian Ridge, and the Ninetyeast Ridge show that magnetic anomalies correlate with some of these features. Preliminary study of anomaly profiles indicates that tracks of anomaly data (the observations minus a core field model) have a power spectrum decreasing as the inverse square of the spatial frequency. An apparent noise floor of about one to two gammas rms is reached at wavelengths of about 360 km, corresponding to approximately 10 samples of the decimated Investigator tape data at a sampling rate of approximately 4.9 sec/sample. J.D.

N82-23571*# Colorado Univ., Boulder. Dept. of Astrogeophysics.

INVESTIGATION OF GEOMAGNETIC FIELD FORECASTING AND FLUID DYNAMICS OF THE CORE Quarterly Status Technical Progress Report, 1 Apr. - 30 Jun. 1981

Edward R. Benton, Principal Investigator 1 Jul. 1981 10 p ERTS

(Contract NAS5-25957)

(E82-10198; NASA-CR-168625; NAS 1.26:168625; QSTPR-6) Avail: NTIS HC A02/MF A01 CSCL 08G

Progress in the use of MAGSAT data to confirm that the radius of the Earth's core-mantle boundary can be accurately determined magnetically is reported. The MAGSAT data was used in conjunction with a high quality manfield model for epoch 1965. The unsigned flux linking the core and mantle of the Earth is considered to be a legitimate invariant for a span of time. The value from MAGSAT of this constant is 16.056 GWb (gigawebers). J.D.

N82-23572*# Business and Technological Systems, Inc., Seabrook, Md.

MAGSAT SCIENCE INVESTIGATIONS Quarterly Report

[1982] 3 p ERTS

(Contract NAS5-26328)

(E82-10199; NASA-CR-168626) Avail: NTIS HC A02/MF A01 CSCL 05B

Progress in the development and modification of software to accommodate total field anomaly data and for spectral analysis of aeromagnetic profile data and computation of depth to magnetic bottom is reported. J.D.

N82-23573*# Washington Univ., St. Louis, Mo. Dept. of Earth and Planetary Science.

STRUCTURE OF THE ST. FRANCOIS MOUNTAINS AND SURROUNDING LEAD BELT, S. E. MISSOURI: INFERENCES FROM THERMAL IR AND OTHER DATA SETS Quarterly Report, 13 May - 31 Jul. 1981

Raymond E. Arvidson, Principal Investigator 1 Nov. 1981 5 p HCMM

(Contract NAS5-26533)

(E82-10200; NASA-CR-168627; NAS 1.26:168627) Avail: NTIS HC A02/MF A01 CSCL 08G

Heat Capacity Mapping Mission (HCMM) in the form of an apparent thermal inertia image were merged with shaded relief maps and Bouguer gravity maps. The HCMM data show that the dominant structural grain in Missouri strikes in a northwesterly direction. The strike is the same as a major basement fault or flexure identified on the basis of gravity images. M.G.

N82-23574*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

INVESTIGATION OF MAGSAT AND TRIAD MAGNETOMETER DATA TO PROVIDE CORRECTIVE INFORMATION ON HIGH-LATITUDE EXTERNAL FIELDS Progress Report, 1 Jul. - 30 Sep. 1981

T. A. Potemra, Principal Investigator 4 Nov. 1981 10 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E82-10201; NASA-CR-168628; NAS 1.26:168628) Avail: NTIS HC A02/MF A01 CSCL 04A

The compilation of a catalog of the MAGSAT-observed high altitude disturbances is discussed and an example of contents and format is given. The graphs allow the investigation of Birkeland current signatures which are superimposed upon the main geomagnetic field. An example of a display of the MAGSAT orbital tracks in a polar geomagnetic coordinate system with the locations, flow directions, and intensities of field aligned currents shown in color is also given. The display was generated using an interactive color graphics terminal. M.G.

N82-23575*# Indian Inst. of Geomagnetism, Bombay.

MAGSAT FOR GEOMAGNETIC STUDIES OVER INDIAN REGION Progress Report, 1 Jan. - 31 Oct. 1981

R. G. Rastogi, B. N. Bhargava, B. P. Singh, D. R. K. Rao, G. K. Rangarajan, R. Rajaram, M. Roy, B. R. Arora, and A. Seth, Principal Investigators 31 Oct. 1981 42 p refs Sponsored by NASA ERTS

(E82-10202; NASA-CR-168629; NAS 1.26:168629; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08G

Progress in the preparation of software for converting data tapes produced on an IBM system to data readable on a DEC-10 system, in the creation of awareness of the utility of MAGSAT data among users in India, and in making computer programs supplied by NASA operational on the DEC-10 system is reported. Papers presented to Indian users, at the IAGA fourth scientific assembly, at a symposium on interdisciplinary approaches to geomagnetism, and a paper published in Science Today are included. J.D.

N82-23576*# Institute of Geological Sciences, Edinburgh (Scotland).

SPHERICAL HARMONIC REPRESENTATION OF THE MAIN GEOMAGNETIC FIELD FOR WORLD CHARTING AND INVESTIGATIONS OF SOME FUNDAMENTAL PROBLEMS OF PHYSICS AND GEOPHYSICS Progress Report

D. R. Barraclough, R. Hide (Meteorological Office), B. R. Leaton, F. J. Lowes (Newcastle-Upon-Tyne Univ.), S. R. C. Malin, and R. L. Wilson, Principal Investigators (Liverpool Univ.) 1 Jun. 1981 4 p Sponsored by NASA ERTS

(E82-10203; NASA-CR-168630; NAS 1.26:168630) Avail: NTIS HC A02/MF A01 CSCL 08G

The data processing of MAGSAT investigator B test tapes and data tapes, and tapes of selected data on 15 magnetically quiet days is reported. The 1980 World Chart spherical model was compared with the MAGSAT (3/80) and MAGSAT vector data were used in the models. An article on modelling the geomagnetic field using satellite data is included. T.M.

N82-23577*# Analytic Sciences Corp., Reading, Mass.

[BATHYMETRIC AND TECTONICS OF INDIAN OCEAN USING MAGSAT DATA] Quarterly Progress Report, 1 Jul. - 30 Sep. 1981

Richard V. Sailor and Andrew R. Lazarewicz, Principal Investigators 15 Oct. 1981 22 p refs ERTS

(Contract NAS5-26424)

(E82-10204; NASA-CR-168631; NAS 1.26:168631) Avail: NTIS HC A02/MF A01 CSCL 05B

The quality of the MAGSAT data was assessed, especially the characterization of spikes. The spectral passbands of significance to geophysical analysis were analyzed, including computations of spectral coherence between nearby repeating satellite tracks. A spectrum modeling effort was begun which is designed to show the effect of spacecraft attitude on the observability of magnetic anomalies. The data obtained is to be used to compute crustal anomaly maps by modeling the equivalent dipoles in the project area. A.R.H.

N82-23578*# Washington Univ., St. Louis, Mo. Dept. of Earth and Planetary Sciences.

STRUCTURE OF THE ST. FRANCOIS MOUNTAINS AND SURROUNDING LEAD BELT, S. E. MISSOURI: INFERENCES FROM THERMAL IR AND OTHER DATA SETS Quarterly Report, 1 Aug. - 31 Oct. 1981

R. E. Arvidson, Principal Investigator 15 Dec. 1981 5 p Original contains imagery. Original imagery may be purchased from NASA, Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send order to 'Attn.: National Space Science Data Center', nondomestic users send order to 'Attn.: World Data Center A for Rockets and Satellites'. HCMM

(Contract NAS5-26533)

(E82-10205; NASA-CR-168632; NAS 1.26:168632) Avail: NTIS HC A02/MF A01 CSCL 08G

Day-IR, day-visible, and night-IR image data sets were analyzed. All three images were contrast enhanced, using a linear stretch. The night-IR image was destriped using a box-car filtering approach. Apparent thermal inertia images were generated from the data. The enhanced data and the apparent thermal inertia image were also registered and overlayed onto shaded relief images depicting topography and onto a colored version of the Missouri geologic map. The combination of the apparent thermal inertial image and the shaded relief map proved to have the greatest discriminability in terms of portraying linear features. The reason seems to be that the vegetation canopy on the Ozark Plateau is different topography, tend to emphasize subtle topographic effects. E.A.K.

N82-23579*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: FOREIGN COMMODITY PRODUCTION FORECASTING. THE 1980 US CORN AND SOYBEANS EXPLORATORY EXPERIMENT Final Report
J. T. Malin and J. G. Carnes, Principal Investigators Oct. 1981 183 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10206; NASA-CR-167485; JSC-17138; NAS 1.26:167485; LEMSCO-16573; FC-L1-04096) Avail: NTIS HC A09/MF A01 CSCL 02C

The U.S. corn and soybeans exploratory experiment is described which consisted of evaluations of two technology components of a production forecasting system: classification procedures (crop labeling and proportion estimation at the level of a sampling unit) and sampling and aggregation procedures. The results from the labeling evaluations indicate that the corn and soybeans labeling procedure works very well in the U.S. corn belt with full season (after tasseling) LANDSAT data. The procedure should be readily adaptable to corn and soybeans labeling required for subsequent exploratory experiments or pilot tests. The machine classification procedures evaluated in this experiment were not effective in improving the proportion estimates. The corn proportions produced by the machine procedures had a large bias when the bias correction was not performed. This bias was caused by the manner in which the machine procedures handled spectrally impure pixels. The simulation test indicated that the weighted aggregation procedure performed quite well. Although further work can be done to improve both the simulation tests and the aggregation procedure, the results of this test show that the procedure should serve as a useful baseline procedure in future exploratory experiments and pilot tests. M.G.

N82-23580*# Department of Agriculture, Houston, Tex.
EVALUATION OF THE DORAISWAMY-THOMPSON WINTER WHEAT CROP CALENDAR MODEL INCORPORATING A MODIFIED SPRING RESTART SEQUENCE
T. W. Taylor, F. W. Ravet, and D. Smika, Principal Investigators Nov. 1981 11 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10207; NASA-CR-167486; JSC-17801; NAS 1.26:167486; EW-U1-04212) Avail: NTIS HC A02/MF A01 CSCL 02C

The Robertson phenology was used to provide growth stage information to a wheat stress indicator mode. A stress indicator model demands two acurate predictions from a crop calendar: date of spring growth initiation; and crop calendar stage at growth initiation. Several approaches for restarting the Robertson phenology model at spring growth initiation were studied. Although best results were obtained with a solar thermal unit method, an alternate approach which indicates soil temperature as the controlling parameter for spring growth initiation was selected and tested. The modified model (Doraiswamy-Thompson) is compared to LACIE-Robertson model predictions. E.A.K.

N82-23581*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AGRISTARS: SUPPORTING RESEARCH. SPRING SMALL GRAINS PLANTING DATE DISTRIBUTION MODEL
T. Hodges and J. A. Artley, Principal Investigators Mar. 1981 33 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10208; NASA-CR-167487; JSC-16858; NAS 1.26:167487; LEMSCO-16018; SR-L1-04032) Avail: NTIS HC A03/MF A01 CSCL 02C

A model was developed using 996 planting dates at 51 LANDSAT segments for spring wheat and spring barley in Minnesota, Montana, North Dakota, and South Dakota in 1979. Daily maximum and minimum temperatures and precipitation were obtained from the cooperative weather stations nearest to each segment. The model uses a growing degree day summation modified for daily temperature range to estimate the beginning of planting and uses a soil surface wetness variable to estimate how a fixed number of planting days are distributed after planting begins. For 1979, the model predicts first, median, and last planting dates with root mean square errors of 7.91, 6.61, and 7.09 days, respectively. The model also provides three or four dates to represent periods of planting activity within the planting season. Although the full model was not tested on an independent data set, it may be suitable in areas other than the U.S. Great Plains where spring small grains are planted as soon as soil and air temperatures become warm enough in the spring for plant growth. T.M.

N82-23582*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DESCRIPTION OF HISTORICAL CROP CALENDAR DATA BASES DEVELOPED TO SUPPORT FOREIGN COMMODITY PRODUCTION FORECASTING PROJECT EXPERIMENTS
W. L. West, III, Principal Investigator Oct. 1981 19 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10209; NASA-CR-167488; JSC-17417; NAS 1.26:167488; LEMSCO-16929; FC-L1-04142) Avail: NTIS HC A02/MF A01 CSCL 02C

The content, format, and storage of data bases developed for the Foreign Commodity Production Forecasting project and used to produce normal crop calendars are described. In addition, the data bases may be used for agricultural meteorology, modeling of stage sequences and planting dates, and as indicators of possible drought and famine. M.G.

N82-23583*# Geological Survey, Denver, Colo.
REGISTRATION OF HEAT CAPACITY MAPPING MISSION DAY AND NIGHT IMAGES
Kenneth Watson, Susanne Hummer-Miller, and Don L. Sawatzky, Principal Investigators [1982] 17 p refs Submitted for publication Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA, Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E82-10210; NASA-CR-168773) Avail: NTIS HC A02/MF A01 CSCL 05B

Neither iterative registration, using drainage intersection maps for control, nor cross correlation techniques were satisfactory in registering day and night HCMM imagery. A procedure was developed which registers the image pairs by selecting control points and mapping the night thermal image to the daytime thermal and reflectance images using an affine transformation on a 1300 by 1100 pixel image. The resulting image registration is accurate to better than two pixels (RMS) and does not exhibit the significant misregistration that was noted in the temperature-difference and thermal-inertia products supplied by NASA. The affine transformation was determined using simple matrix arithmetic, a step that can be performed rapidly on a minicomputer. A.R.H.

N82-23584*# Geological Survey, Denver, Colo.
GROUND SUPPORT DATA FROM JULY 10 TO JULY 29, 1978, FOR HCMM THERMAL SATELLITE DATA OF THE POWDER RIVER BASIN, WYOMING
Susanne Hummer-Miller, Kenneth Watson, and Roy Kipfinger, Principal Investigators 1980 48 p ref Sponsored by NASA HCMM
(E82-10211; NASA-CR-168772; NAS 1.26:168772; USGS-OFR-80-469) Avail: NTIS HC A03/MF A01 CSCL 08I

Radiometric and meteorological data acquired at three ground stations located approximately 150 km apart in the Powder River Basin, Wyoming, are summarized. The data were collected between July 10 and July 29, 1978, to support the HCMM thermal satellite data acquired during this time period. The parameters measured are direct solar radiance, total solar radiance, sky radiance, air temperature, relative humidity, wind speed, and wind direction. A tabulation of the measurement accuracies is presented. J.D.

N82-23585*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

SPECTRAL PROPERTIES OF AGRICULTURAL CROPS AND SOILS MEASURED FROM SPACE, AERIAL, FIELD, AND LABORATORY SENSORS

M. E. Bauer, Principal Investigator, V. C. Vanderbilt, B. F. Robinson, and C. S. T. Daughtry Nov. 1982 21 p refs Repr. from Proc. of the Intern. Arch. of Photogrammetry (West Germany), v. 23(B7), 1980 p 56-73 Presented at the 14th Congr. of the Intern. Soc. for Photogrammetry, Hamburg, 13-15 Jul. 1980 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E82-10212; NASA-CR-167507; SR-P1-04200; NAS 1.26:167507; LARS-071380) Avail: NTIS HC A02/MF A01 CSCL 02C

The state of knowledge of the multispectral reflectance characteristics of crops and soils as measured from laboratory, field, aerial, and satellite sensor systems is reviewed emphasizing current investigations. The relationships of important biological and physical characteristics to their spectral properties of crops and soils are addressed. Future research needs are defined. M.G.

N82-23586*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

MULTISTAGE CLASSIFICATION OF MULTISPECTRAL EARTH OBSERVATIONAL DATA: THE DESIGN APPROACH

M. E. Bauer, Principal Investigators, M. J. Muasher, and D. A. Landgrebe Dec. 1981 181 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E82-10213; NASA-CR-167508; NAS 1.26:167508; LARS-101481; SR-P1-04194) Avail: NTIS HC A09/MF A01 CSCL 02C

An algorithm is proposed which predicts the optimal features at every node in a binary tree procedure. The algorithm estimates the probability of error by approximating the area under the likelihood ratio function for two classes and taking into account the number of training samples used in estimating each of these two classes. Some results on feature selection techniques, particularly in the presence of a very limited set of training samples, are presented. Results comparing probabilities of error predicted by the proposed algorithm as a function of dimensionality as compared to experimental observations are shown for aircraft and LANDSAT data. Results are obtained for both real and simulated data. Finally, two binary tree examples which use the algorithm are presented to illustrate the usefulness of the procedure. Author

N82-23587*# Geological Survey, Denver, Colo.

TOPOGRAPHIC SLOPE CORRECTION FOR ANALYSIS OF THERMAL INFRARED IMAGES

Kenneth Watson, Princpal Investigator [1982] 14 p refs HCMM

(NASA Order S-40256-B)

(E82-10214; NASA-CR-168774; NAS 1.26:168774) Avail: NTIS HC A02/MF A01 CSCL 08B

A simple topographic slope correction using a linearized thermal model and assuming slopes less than about 20 degrees is presented. The correction can be used to analyzed individual thermal images or composite products such as temperature difference or thermal inertia. Simple curves are provided for latitudes of 30 and 50 degrees. The form is easily adapted for analysis of HCMM images using the DMA digital terrain data. Author

N82-23588*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

DETERMINATION OF THE OPTIMAL LEVEL FOR COMBININC AREA AND YIELD ESTIMATES

Marvin E. Bauer, Principal Investigator, M. M. Hixson, and C. D. Jobusch 12 Oct. 1981 71 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E82-10215; NASA-CR-167511; FC-P1-04197; NAS 1.26:167511; LARS-101281) Avail: NTIS HC A04/MF A01 CSCL 02C

Several levels of obtaining both area and yield estimates are considered: county, refined strata, refined/split strata, crop reporting district, and state. Using the CCEA model form and smoothed weather data, regression coefficients at each level were derived to compute yield and its variance. The variance of the yield estimates was largest at the state and smallest at the county level for the two crops studied: corn and soybeans. The refined strata had somewhat larger variances than those associated with the refined/split strata and CRD. For production estimates, the difference in standard deviations among levels was not large for corn, but for soybeans the standard deviation at the state level was more than 50% greater than for the other levels. The refined strata had the smallest standard deviations. T.M.

N82-23589*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AGRISTARS. PRELIMINARY TECHNICAL RESULTS REVIEW OF FY81 EXPERIMENTS, VOLUME 2: FISCAL YEAR 1981/1982 'CORN AND SOYBEANS PILOT' EXPERIMENT

29 Sep. 1981 170 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E82-10216; NASA-TM-84206; JSC-17433-Vol-2; NAS 1.15:84206; FC-J1-04175-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 02C

The performance of the technology exhibited significant proportion estimation errors, specifically, high mean error in both corn and soybeans area estimation. The data systems, technical approaches, and data assessment of the pilot experiment were reviewed. Results of proportion estimations procedure performance evaluations, and sensitivity evaluations are presented. The role of the pilot experiment in foreign technology development is discussed. T.M.

N82-23590*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

APPLICATION OF THERMAL MODEL FOR PAN EVAPORATION TO THE HYDROLOGY OF A DEFINED MEDIUM, THE SPONGE

M. H. Trenchard and J. A. Artley, Principal Investigators Nov. 1981 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10217; NASA-CR-167479; JSC-17440; NAS 1.26:167479; LEMSCO-16935; FC-L1-04192) Avail: NTIS HC A02/MF A01 CSCL 02C

A technique is presented which estimates pan evaporation from the commonly observed values of daily maximum and minimum air temperatures. These two variables are transformed to saturation vapor pressure equivalents which are used in a simple linear regression model. The model provides reasonably accurate estimates of pan evaporation rates over a large geographic area. The derived evaporation algorithm is combined with precipitation to obtain a simple moisture variable. A hypothetical medium with a capacity of 8 inches of water is initialized at 4 inches. The medium behaves like a sponge: it absorbs all incident precipitation, with runoff or drainage occurring only after it is saturated. Water is lost from this simple system through evaporation just as from a Class A pan, but at a rate proportional to its degree of saturation. The contents of the sponge is a moisture index calculated from only the maximum and minium temperatures and precipitation. T.M.

N82-23591*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A METEOROLOGICALLY DRIVEN GRAIN SORGHUM STRESS INDICATOR MODEL

T. W. Taylor (Agricultural Research Service, Houston, Tex.) and F. W. Ravet, Principal Investigators Nov. 1981 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E82-10218; NASA-TM-84740; JSC-17797; NAS 1.15:84740;

EW-U1-04208) Avail: NTIS HC A02/MF A01 CSCL 02C

A grain sorghum soil moisture and temperature stress model is described. It was developed to serve as a meteorological data filter to alert commodity analysts to potential stress conditions and crop phenology in selected grain sorghum production areas. The model also identifies optimum conditions on a daily basis and planting/harvest problems associated with poor tractability. T.M.

N82-23592*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AGRISTARS. PROJECT MANAGEMENT REPORT: PROGRAM REVIEW PRESENTATION TO LEVEL 1, INTERAGENCY COORDINATION COMMITTEE

3 Nov. 1981 105 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E82-10219; NASA-TM-84203; JSC-17792; NAS 1.15:84203; SR-J1-04195) Avail: NTIS HC A06/MF A01 CSCL 02C

The AgRISTARS supporting research projects in the areas of data systems, scene radiation, and pattern recognition are reviewed. The objectives, activities, and accomplishments of FY-80 and the objectives and status of FY-81 programs are described. M.G.

N82-23593*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AIRBORNE OBSERVED SOLAR ELEVATION AND ROW DIRECTION EFFECTS ON THE NEAR-IR/RED RATIO OF COTTON

J. P. Millard, R. D. Jackson (Science and Education Administration, Phoenix, Ariz.), R. C. Goettelman (EAL Corp., Richmond, Calif.), and M. J. LeRoy, Principal Investigators (DCA Corp., Palo Alto, Calif.) Aug. 1981 14 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E82-10220; NASA-TM-84204; JSC-17420; NAS 1.15:84204; EW-U1-04144) Avail: NTIS HC A02/MF A01 CSCL 02C

An airborne multispectral scanner was used to obtain data over two adjacent cotton fields having rows perpendicular to one another, at three times of day (different solar elevations), and on two dates (different plant size). The near IR/red ratios were displayed in image form, so that within-field variations and differences between fields could be easily assessed. The ratio varied with changing Sun elevation for north-south oriented rows, but no variation was detected for east-west oriented rows. A.R.H.

N82-23594*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

NORMAL CROP CALENDARS. VOLUME 3: THE CORN AND SOYBEAN STATES OF ILLINOIS, INDIANA, AND IOWA

William L. West, III, Principal Investigator Oct. 1981 79 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10221; NASA-CR-167446; JSC-17432; NAS 1.26:167446; LEMSCO-16944; FC-L1-04172) Avail: NTIS HC A05/MF A01 CSCL 02C

The state and crop reporting distric crop calendars for Iowa, Illinois, and Indiana are presented. Crop calendars for corn, soybeans, sorghum, oats, wheat, barley, clover, flax, sugar beets, and tobacco are included. J.D.

N82-23595*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

SELECTION OF THE AUSTRALIAN INDICATOR REGION

C. R. Reed, Principal Investigator Sep. 1981 73 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10222; NASA-CR-167406; JSC-17421; NAS 1.26:167406; LEMSCO-15682; FC-L1-04145) Avail: NTIS HC A04/MF A01 CSCL 02C

Each Australian state was examined for the availability of LANDSAT data, area, yield, and production characteristics, statistics, crop calendars, and other ancillary data. Agrophysical conditions that could influence labeling and classification accuracies were identified in connection with the highest producing states as determined from available Australian crop statistics. Based primarily on these production statistics, Western Australia and New South Wales were selected as the wheat indicator region for Australia. The general characteristics of wheat in the indicator region, with potential problems anticipated for proportion estimation are considered. The varieties of wheat, the diseases and pests common to New South Wales, and the wheat growing regions of both states are examined. A.R.H.

N82-23596*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATION OF VICAR SOFTWARE CAPABILITY FOR LAND INFORMATION SUPPORT SYSTEM NEEDS

S. S. Yao, Principal Investigator Sep. 1981 19 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10223; NASA-CR-167442; JSC-17431; NAS 1.26:167442; LEMSCO-17269; RR-L1-17269) Avail: NTIS HC A02/MF A01 CSCL 09B

A preliminary evaluation of the processing capability of the VICAR software for land information support system needs is presented. The geometric and radiometric properties of four sets of LANDSAT data taken over the Elk River, Idaho quadrangle were compared. Storage of data sets, the means of location, pixel resolution, and radiometric and geometric characteristics are described. Recommended modifications of VICAR programs are presented. J.D.

N82-23597*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

AGRISTARS: RENEWABLE RESOURCES INVENTORY. LAND INFORMATION SUPPORT SYSTEM IMPLEMENTATION PLAN AND SCHEDULE

S. S. Yao, Principal Investigator Sep. 1981 29 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E82-10224; NASA-CR-167441; JSC-17434; NAS 1.26:167441; LEMSCO-17276; RR-L1-00641) Avail: NTIS HC A03/MF A01 CSCL 05B

The planning and scheduling of the use of remote sensing and computer technology to support the land management planning effort at the national forests level are outlined. The task planning and system capability development were reviewed. A user evaluation is presented along with technological transfer methodology. A land management planning pilot test of the San Juan National Forest is discussed. T.M.

N82-23598*# Science and Education Administration, Weslaco, Tex.

AGRISTARS: EARLY WARNING AND CROP CONDITION ASSESSMENT. PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Final Report, 1 Dec. 1977 - Sep. 1 1980

Craig L. Wiegand, Principal Investigator, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson Aug. 1981 185 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(NASA Order S-40198B; Proj. AgRISTARS)

(E82-10225; NASA-CR-167440; JSC-17143; NAS 1.26:167440; EW-U1-04103) Avail: NTIS HC A09/MF A01 CSCL 02C

Emissive (10.5 to 12.5 microns) and reflective (0.55 to 1.1 microns) data for ten day scenes and infrared data for six night scenes of southern Texas were analyzed for plant cover, soil temperature, freeze, water stress, and evapotranspiration. Heat capacity mapping mission radiometric temperatures were: within 2 C of dewpoint temperatures, significantly correlated with variables important in evapotranspiration, and related to freeze severity and planting depth soil temperatures. Author

N82-23599*# Texas Univ. at Dallas. Center for Space Sciences.
INVESTIGATION OF THE EFFECTS OF EXTERNAL CURRENT SYSTEMS ON THE MAGSAT DATA UTILIZING GRID CELL MODELING TECHNIQUES Quarterly Status Technical Progress Report, 1 Oct. - 31 Dec. 1981
David M. Klumpar, Principal Investigator 9 Jan. 1982 10 p ERTS
(Contract NAS5-26309)
(E82-10226; NASA-CR-168800; NAS 1.26:168800; QSTPR-5) Avail: NTIS HC A02/MF A01 CSCL 05B

Efforts in support of the development of a model of the magnetic fields due to ionospheric and magnetospheric electrical currents are discussed. Specifically, progress made in reading MAGSAT tapes and plotting the deviation of the measured magnetic field components with respect to a spherical harmonic model of the main geomagnetic field is reported. Initial tests of the modeling procedure developed to compute the ionosphere/magnetosphere-induced fields at satellite orbit are also described. The modeling technique utilizes a liner current element representation of the large scale current system. M.G.

N82-23600*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
APPLICATION OF COMPUTER AXIAL TOMOGRAPHY (CAT) TO MEASURING CROP CANOPY GEOMETRY
M. E. Bauer, V. C. Vanderbilt, Principal Investigators, and R. W. Kilgore Jun. 1981 9 p refs Repr. from 1981 Intern. Geosci. and Remote Sensing Sym. (IGARSS'81), IEEE Catalog no. 81CH1656-8, 1981 p 1162-1167 Sym. held in Washington, D.C., 8-10 Jun. 1981 ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10227; NASA-CR-167397; NAS 1.26:167397; LARS-TR-060881; SR-P1-04141) Avail: NTIS HC A02/MF A01 CSCL 02C

The feasibility of using the principles of computer axial topography (CAT) to quantify the structure of crop canopies was investigated because six variables are needed to describe the position-orientation with time of a small piece of canopy foliage. Several cross sections were cut through the foliage of healthy, green corn and soybean canopies in the dent and full pod development stages, respectively. A photograph of each cross section representing the intersection of a plane with the foliage was enlarged and the air-foliage boundaries delineated by the plane were digitized. A computer program was written and used to reconstruct the cross section of the canopy. The approach used in applying optical computer axial tomography to measuring crop canopy geometry shows promise of being able to provide needed geometric information for input data to canopy reflectance models. The difficulty of using the CAT scanner to measure large canopies of crops like corn is discussed and a solution is proposed involving the measurement of plants one at a time. A.R.H.

N82-23601*# Agricultural Research Services, Beltsville, Md.
AGRICULTURAL RESEARCH SERVICE RESEARCH HIGHLIGHTS IN REMOTE SENSING FOR CALENDAR YEAR 1980 Annual Report
Jerry C. Ritchie, Principal Investigator Jul. 1981 27 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10228; NASA-CR-167408; EW-R1-04147; NAS 1.26:167408) Avail: NTIS HC A03/MF A01 CSCL 02C

The AR research mission in remote sensing is to develop the basic understanding of the soil plant animal atmosphere continuum in agricultural ecosystems and to determine when remotely sensed data can be used to provide information about these agricultural ecosystems. A brief statement of the significant results of each project is given. A list of 1980 publication and location contacts is also given. T.M.

N82-23602*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
LINEAR POLARIZATION OF LIGHT BY TWO WHEAT CANOPIES MEASURED AT MANY VIEW ANGLES
M. E. Bauer, Principal Investigator, V. C. Vanderbilt, L. L. Biehl, B. F. Robinson, and A. S. Vanderbilt Sep. 1981 11 p refs Repr. from Intern. Collog. on Spectral Signatures of Objects in Remote Sensing, 1980 Collog. held in Avignon, France, 8-11 Sep. 1980 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10229; NASA-CR-167419; NAS 1.26:167419; LARS-TR-090981; SR-P1-04139) Avail: NTIS HC A02/MF A01 CSCL 20F

The linear polarization and reflection of visible light by wheat as a function of sun-view diections, crop development stage, and wavelength were examined. Two-hundred spectra were taken continuously in wave-lengths from 0.45 to 0.72 Micron in 33 view directions using an Exotech model 20C spectroradiometer six meters above two wheat canopies in the boot and fully headed maturity stages. The analysis results show that the amount of linearly polarized light from the wheat canopies is greatest in the blue spectral region and decreases gradually with increasing wavelength. The results also show that the linearly polarized light from the canopies is generally greatest in the azimuth direction of the Sun and tends toward zero as the view direction tends toward the direction of the hot spot or anti-solar point. It is demonstrated that the single, angle of incidence of sunlight on the leaf, explains almost all of the variation of the amount of polarized light with Sun-view direction. M.G.

N82-23603*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EVALUATION OF THE PROCEDURE FOR SEPARATING BARLEY FROM OTHER SPRING SMALL GRAINS
E. R. Magness, Principal Investigator Aug. 1980 77 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10230; NASA-CR-160888; JSC-16752; NAS 1.26:160888; LEMSCO-14598; FC-LO-00472) Avail: NTIS HC A05/MF A01 CSCL 02C

The success of the Transition Year procedure to separate and label barley and the other small grains was assessed. It was decided that developers of the procedure would carry out the exercise in order to prevent compounding procedural problems with implementation problems. The evaluation proceeded by labeling the sping small grains first. The accuracy of this labeling was, on the average, somewhat better than that in the Transition Year operations. Other departures from the original procedure included a regionalization of the labeling process, the use of trend analysis, and the removal of time constraints from the actual processing. Segment selection, ground truth derivation, and data available for each segment in the analysis are discussed. Labeling accuracy is examined for North Dakota, South Dakota, Minnesota, and Montana as well as for the entire four-state area. Errors are characterized. A.R.H.

N82-23604*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS. PROJECT MANAGEMENT REPORT: PROGRAM REVIEW PRESENTATION TO LEVEL 1, INTERAGENCY COORDINATION COMMITTEE Semiannual Report
Nov. 1981 232 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development
(Proj. AgRISTARS)
(E82-10231; NASA-TM-84205; JSC-17438; NAS 1.15:84205; FC-J1-04181) Avail: NTIS CSCL 02C

Accomplishments relating to the development of crop calendars and production estimates for spring small grains, corn, and soybeans and the associated data acquisition and processing systems are reviewed. The areas of interest included the Great Plains Corridor and Argentina. M.G.

N82-23605*# Texas Univ. at Dallas. Center for Space Sciences.
INVESTIGATION OF THE EFFECTS OF EXTERNAL CURRENT SYSTEMS ON THE MAGSAT DATA UTILIZING GRID CELL MODELING TECHNIQUES Quarterly Status Technical Progress Report, 1 Jul. - 30 Sep. 1981
David M. Klumpar, Principal Investigator 12 Oct. 1981 9 p

Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Contract NAS5-26309)
(E82-10232; NASA-CR-168801; NAS 1.26:168801; QSTPR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

Progress is reported in reading MAGSAT tapes in modeling procedure developed to compute the magnetic fields at satellite orbit due to current distributions in the ionosphere. The modeling technique utilizes a linear current element representation of the large-scale space-current system. Author

N82-23606*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A MODEL OF PLANT CANOPY POLARIZATION
V. C. Vanderbilt Jun. 1980 12 p refs Repr. from Machine Process. of Remotely Sensed Data, Jun. 1980 p 98-108 Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10233; NASA-CR-167415; SR-P1-04170; NAS 1.26:167415; LARS-060580) Avail: NTIS HC A02/MF A01 CSCL 20F

A model for the amount of linearly polarized light reflected by the shiny leaves of grain crops is based on the morphological and phenological characteristics of the plant canopy and upon the Fresnel equations which describe the light reflection process at the smooth boundary separating two dielectrics. The theory used demonstrates that, potentially, measurements of the linearly polarized light from a crop canopy may be used as an additional feature to discriminate between crops such as wheat and barley, two crops which are so spectrally similar that they are misclassified with unacceptable frequency. Examination of the model suggests that, potentially, satellite polarization measurements may be used to monitor crop development stage, leaf water content, leaf area index, hail damage, and certain plant diseases. The information content of these measurements is needed to evaluate the proposed polarization sensor for the satellite-borne multispectral resource sampler. A.R.H.

N82-23607*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
USE AND APPLICABILITY OF THE VEGETATION COMPONENT OF THE NATIONAL SITE CLASSIFICATION SYSTEM
C. A. Clark, Principal Investigator Apr. 1981 43 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10234; NASA-CR-167416; JSC-17122; NAS 1.26:167416; LEMSCO-15173; RR-LO-00466) Avail: NTIS HC A03/MF A01 CSCL 02C

Existing vegetation on a site in Sumter National Forest, South Carolina was classified using high altitude aerial optical bar color infrared photography in an effort to determine if the National Site Classification (NSC) system could be used in the heterogeneously forested southeastern United States where it had not previously been used. Results show that the revised UNESCO international classification and mapping of vegetation system, as incorporated into the NSCS, is general enough at the higher levels and specific enough at the lower levels to adequately accommodate densely forested, heterogeneous areas as well as the larger, more homogeneous regions of the Pacific Northwest. The major problem is of existing vegetation versus natural vegetation. A.R.H.

N82-23608*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
DESCRIPTION OF THE FORTRAN IMPLEMENTATION OF THE SPRING SMALL GRAINS PLANTING DATE DISTRIBUTION MODEL
J. A. Artley, Principal Investigator Aug. 1981 55 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E82-10235; NASA-CR-167411; JSC-17414; NAS 1.26:167411; LEMSCO-16854; SR-L1-00309) Avail: NTIS HC A04/MF A01 CSCL 02C

The Hodges-Artley spring small grains planting date distribution model was coded in FORTRAN. The PLDRVR program, which implements the model, is described and a copy of the code is provided. The purpose, calling procedure, local variables, and input/output devices for each subroutine are explained to supplement the user's guide. A.R.H.

N82-23609*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS: AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING Annual Report
Jun. 1981 68 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10236; NASA-TM-84202; JSC-17398; NAS 1.15:84202; AP-J0-04111) Avail: NTIS HC A04/MF A01 CSCL 02C

The major objectives and FY 1980 accomplishments are described of a long term program designed to determine the usefulness, cost, and extent to which aerospace remote sensing data can be integrated into existing or future USDA systems to improve the objectivity, reliability, timeliness, and adequacy of information. A general overview, the primary and participating agencies, and the technical highlights of each of the following projects are presented: early warning/crop condition assessment; foreign commodity production forecasting; yield model development; supporting research; soil moisture; domestic crops and land cover; renewable resources incentory; and conservation and pollution. A.R.H.

N82-23610*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
CANOPY REFLECTANCE AS INFLUENCED BY SOLAR ILLUMINATION ANGLE
M. E. Bauer, Principal Investigator, J. C. Kollenkark, V. C. Vanderbilt, and C. S. T. Daughtry Mar. 1981 24 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E82-10237; NASA-CR-167402; SR-P1-04039; NAS 1.26:167402; LRS-021681) Avail: NTIS HC A02/MF A01 CSCL 20F

The interaction of the solar illumination angle and row azimuth angle of the measured reflectance factor (RF) of soybean canopies was investigated. Diurnal changes of nearly 140% were observed in the red wavelength region when canopies covered 64% of the soil. The amount of shadow observed was a function of the plant geometry and row width. As soil cover approached 100%, the diurnal changes diminished. A function tht describes the solar illumination angle with respect to the row azimuth explained most of the diurnal variation in the measured RF. Variation in near infrared response was much less and did not appear to be as strongly related to Sun-row angle interactions. The near infrared/red ratio was highly sensitive to Sun angle-row direction interactions, whereas the greenness function, utilizing all four spectral bands, was not. J.D.

N82-23611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MULTI-FREQUENCY RADIOMETRIC MEASUREMENT OF SOIL MOISTURE CONTENT OVER BARE AND VEGETATED FIELDS
J. R. Wang, T. J. Schmugge, J. E. McMurtrey, III (Dept. of Agriculture, Beltsville, Md.), W. I. Gould, W. S. Glazar, and J. E. Fuchs, Principal Investigators Oct. 1981 16 p refs Submitted for publication Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E82-10238; NASA-TM-83842; SM-GI-04178; NAS 1.15:83842) Avail: NTIS HC A02/MF A01 CSCL 08M

A USDA Beltsville Agricultural Research Center site was used for an experiment in which soil moisture remote sensing over bare, grass, and alfalfa fields was conducted over a three-month period using 0.6 GHz, 1.4 GHz, and 10.6 GHz

Dicke-type microwave radiometers mounted on mobile towers. Ground truth soil moisture content and ambient air and soil temperatures were obtained concurrently with the radiometric measurements. Biomass of the vegetation cover was sampled about once a week. Soil density for each of the three fields was measured several times during the course of the experiment. Results of the radiometric masurements confirm the frequency dependence of moisture sensing sensitivity reduction reported earlier. Observations over the bare, wet field show that the measured brightness temperature is lowest at 5.0 GHz and highest of 0.6 GHz frequency, a result contrary to expectation based on the estimated dielectric permittivity of soil water mixtures and current radiative transfer model in that frequency range.
Author

N82-23612*# Tokyo Univ. (Japan).
INVESTIGATION FROM JAPANESE MAGSAT TEAM Progress Report, 15 Mar. 1980 - 15 Jul. 1981
Naoshi Fukushima, Principal Investigator 20 Jul. 1981 10 p Sponsored by NASA ERTS
(E82-10239; NASA-CR-168755; NAS 1.26:168755; PR-3) Avail: NTIS HC A02/MF A01 CSCL 05B

The acquisition of tapes which contain vector and scalar data decimated at an interval of 0.5 sec, together with time and position data, is reported. Progress in the study of magnetic anomalies in the vicinity of Japan and in electric currents in the ionosphere and magnetosphere is also reported. MAGSAT data was used in obtaining a map of total force anomaly for the area of latitude 10-70 deg N and longitude 110-170 deg E. One of the outstanding features in the map of the magnetic anomaly is a negative magnetic anomaly in the Okhotsk Sea, which is of geophysical interest because of its possible connection with high heat flow values in that area. T.M.

N82-23613*# Miami Univ., Fla. School of Marine and Atmospheric Science.
INVESTIGATIONS OF MEDIUM WAVELENGTH MAGNETIC ANOMALIES IN THE EASTERN PACIFIC USING MAGSAT Interim Report, Jul. - Sep. 1981
Christopher G. A. Harrison, Principal Investigator Nov. 1981 2 p Sponsored by NASA ERTS
(E82-10240; NASA-CR-168756; NAS 1.26:168756) Avail: NTIS HC A02/MF A01 CSCL 08G

Progress in study of the details of spherical harmonic representations of the Earth's magnetic field is reported. The first of the Investigator B quiet time tapes were received and determined to be error free. J.D.

N82-23614*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYSIS OF OCEAN COLOR SCANNER DATA FROM THE SUPERFLUX III EXPERIMENT
Craig W. Ohlhorst Mar. 1982 30 p ref
(NASA-TM-83290; NAS 1.15:83290) Avail: NTIS HC A03/MF A01 CSCL 08J

The scanner collected data on October 15, 20, and 22, 1980. Single-channel gray-scale data products generated 5 minutes after the scanner were collected and showed details of the Chesapeake plume structure, suggesting that this quick-look capability could have potential use for experiments in real time. The Chesapeake Bay plume extended offshore about 5 nautical miles on October 15, and 7 nautical miles on October 20. Using the October 15 1980, data, a correlation coefficient of $r = 0.889$ was obtained between chlorophyll 'A' and the ratio of band 7 (664-684 nanometers) to band 9 (746-766 nanometers). This ratio was then used to calculate the average surface chlorophyll 'A' concentration of the water flowing out of the Chesapeak Bay. A ratio from the Ocean Color Scanner bands was created to simulate the ratio that the Multichannel Ocean Color Sensor uses to calculate chlorophyll A concentrations. Using the October 15, 1980, data set, this ratio has a correlation coefficient of $r = -0.739$ with the log of the chlorophyll 'A' and the ratio of band 2 minus band 4 to band 2 plus band 4 of the Ocean Color Scanner. No correlation is found between the Ocean Color Scanner data and total suspended solid measurements made on October 15, 1980. T.M.

N82-23615# Battelle Pacific Northwest Labs., Richland, Wash.
VARIABLE THICKNESS TRANSIENT GROUNDWATER FLOW MODEL: USER'S MANUAL Final Report
F. W. Bond, C. A. Newbill, and P. J. Gutknecht Aug. 1981 135 p refs
(Contract DE-AC06-76RL-01830)
(DE82-000917; EPRI-CS-2011) Avail: NTIS HC A07/MF A01

The central thrust of the research and development work was to implement numerical models for description and prediction of subsurface leachate movement in saturated and partially saturated flow systems in soil beneath Flue Gas Desulfurization (FGD) sludge disposal areas. A subtask of this project was to document the modeling technology to make it generally useful to EPRI and the power companies for evaluation of ground disposal of wastes and sludges. This report is the first in a series of user's manuals which will describe the use of groundwater flow (both saturated and partially saturated) and transport codes. This document describes the use of the Variable Thickness Transient (VTT) groundwater flow code. The VTT code uses finite difference techniques to simulate two dimensional saturated groundwater flow. The code can be used to simulate either confined or unconfined aquifer conditions in either a steady state or transient mode. The code can model one, two or three geologic layers.
DOE

N82-23616# California Univ., Livermore. Lawrence Livermore Lab.
OIL SHALE PROJECT RUN SUMMARY LARGE RETORT RUN L-4
J. H. Raley, J. H. Campbell, W. A. Sandholtz, F. J. Ackerman, R. G. Mallon, L. L. Ott, and J. J. Ronchetto 5 Nov. 1981 105 p refs
(Contract W-7405-eng-48)
(DE82-003627; UCID-19238) Avail: NTIS HC A06/MF A01

A simulated MIS experiment was carried out in the 6 metric ton oil shale retort. An oil yield of 87% FA was achieved at a retorting rate of 2.8 to 3.0 m/day with a shale bed of -30 +0.001 cm particle size range and including a nearly two fold step change in grade. Temperature control was maintained by varying the steam/air ratio and injection gas rate. Oil yield, front position and retorting rate, as predicted in real time during the run from offgas data, agreed reasonably well with directly measured counterparts. Pre-run model calculations reliably predicted operating conditions for both inert gas pre-ignition and combustion retorting phases of the run. Pre-run steam logging predicted the degree of horizontal uniformity of the retorting front. Ultrasonic reflectometry, gas releasing capsules and differential pressure measurements were shown to be promising methods for temperature measurement. Passage of the retorting front through the grade change was signalled by changes in offgas composition.
DOE

N82-23617# Pacific Northwest Lab., Richland, Wash.
WESTERN OIL SHALE DEVELOPMENT: A TECHNOLOGY ASSESSMENT. VOLUME 1: MAIN REPORT Final Report
Darryl Hessel and Gabor Strasser Nov. 1981 360 p refs
(Contract DE-AC06-76RL-01830)
(DE82-003132; PNL-3830-Vol-1) Avail: NTIS HC A16/MF A01

The prospects of shale oil use are discussed within the context of environmental constraints, available natural and economic resources, and the characteristics of existing and emerging technology. Shale oil technologies are reviewed objectively as a means of supplying domestically produced fuels within environmental, social, economic, and legal/institutional contraints. Using available data, analyses, and experienced judgment, the major points of uncertainty regarding potential impacts of oil shale development are examined. Issues which cannot be resolved on the bases of the data, analyses, and experienced judgment currently available are identified. When appropriate and feasible, ways for the removal of existing uncertainties that stand in the way of resolving outstanding issues are suggested. DOE

N82-23618# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
HEAT FLOW AND GEOTHERMAL ASSESSMENT OF THE ESCALANTE DESERT, SOUTHWESTERN UTAH, WITH

EMPHASIS ON THE NEWCASTLE KGRA
M. D. Clement and D. S. Chapman Feb. 1981 126 p refs
(Contract DE-AC07-79ID-12079)
(DE82-003952; DOE/ID-12079/28) Avail: NTIS HC A07/MF A01

Twenty-five regional heat flow measurements are presented for the Escalante Desert region within the Great Basin of the western US. Heat flow excluding geothermal areas ranges from 42 to 350 mW/sq m but much of the variability may be caused by deeply circulating groundwater redistributing the regional flux. A subset of 10 sites drilled specifically to characterize the heat flow of the region yielded a mean of 100 mW/sq m with a standard cylindrical discs and rock chips of rhyolite to andesite tuffs emphasized the importance of porosity corrections to thermal conductivity measurements. A blind geothermal system southwest of Newcastle, Utah, situated within the Escalante Desert was also studied. Heat flow results from 11 local drillholes yield values between 163 and 3065 mW/sq m. The 500 mW/sq m contour encloses an area of 9.4 sq km. By integrating the anomalous flux above background over the thermal anomaly, a thermal power loss of 12.8 mW and corresponding subsurface mass discharge of 32 kg/s are calculated for this geothermal system. DOE

N82-23619# Gruy Federal, Inc., Houston, Tex.
TARGET RESERVOIRS FOR CO2 MISCIBLE FLOODING. TASK TWO: SUMMARY OF AVAILABLE RESERVOIR AND GEOLOGICAL DATA. VOLUME 1: PERMIAN BASIN GEOLOGICAL AND RESERVOIR DATA, PART 1. PERMIAN BASIN RESERVOIR SELECTION PROCEDURE, GEOLOGY, AND RESERVOIR DATA SUMMARY Final Report
L. B. Cobb and John H. Goodrich Oct. 1981 134 p refs Prepared in cooperation with Morgantown Energy Technology Center, W. Va.
(Contract DE-AC21-79MC-08341)
(DE82-001349; DOE/MC-08341/31-Vol-1-Pt-1) Avail: NTIS HC A07/MF A01

An engineering foundation to serve as the basis for field mini- and pilot tests in both high and low oil saturation carbonate reservoirs for the purpose of extending the techology base in carbon dioxide miscible flooding is presented. Six tasks were studied and are as follows: summary of available CO2 field test data: summary of existing reservoir and geological data; selection of target reservoirs; selection of specific reservoirs for CO2 injection tests; selection of specific sites for test wells in carbonate reservoirs; and drilling and coring activities. DOE

N82-23620# Gruy Federal, Inc., Houston, Tex.
TARGET RESERVOIRS FOR CO2 MISCIBLE FLOODING. TASK TWO: SUMMARY OF AVAILABLE RESERVOIR AND GEOLOGICAL DATA. VOLUME 1: PERMIAN BASIN GEOLOGICAL AND RESERVOIR DATA; PART 3. FARMER-SAN ANDRES THROUGH NOLLEY-WOLFCAMP Final Report
LaVerne B. Cobb Oct. 1981 358 p
(Contract DE-AC21-79MC-08341)
(DE82-001347; DOE/MC-08341/31-Vol-1-Pt-3) Avail: NTIS HC A16/MF A01

A summary of existing reservoir and geological data on carbonate reservoirs located in the Permian basin of west Texas and southeast New Mexico is given. The data may serve as a basis for field mini- and pilot tests in both high and low oil saturation carbonate reservoirs for the purpose of extending the technology base in carbon dioxidemisicible flooding. DOE

N82-23621# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. ROSEAU QUADRANGLE, MINNESOTA, VOLUME 1 Final Report
May 1981 98 p refs Prepared for Bendix Field Engineering Corp., Grand Junction, Colo. 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-001031; GJBX-329-81-Vol-1) Avail: NTIS HC A05/MF A01

An airborne high sensitivity gamma ray spectrometer and magnetometer survey was conducted over the Roseau map area in Minnesota. Radiometric multiple parameter, magnetic, and ancillary parameter stacked profiles are discussed. Hostograms, anomaly, and computer printer maps are also discussed. Stratigraphy is described. Geochemical, printer contour, and anomaly map analyses are provided. N.W.

N82-23622# Pacific Northwest Lab., Richland, Wash. Technology Assessments Div.
WESTERN OIL SHALE DEVELOPMENT. A TECHNOLOGY ASSESSMENT Final Report
Nov. 1981 31 p
(Contract DE-AC06-76RL-01830)
(DE82-003004; PNL-3830-Exec-Summ) Avail: NTIS HC A03/MF A01

Shale oil technologies as a means of supplying domestically produced fuels within environmental, social, economic, and legal/institutional constraints are reviewed, using available data, analyses, and experienced judgment, to examine the major points of uncertainty regarding potential impacts of oil shale development. Issues where data and analyses are compelling or where conclusions can be reached on judgmental grounds are resolved and issues which cannot be resolved on the bases of the data, analyses, and experienced judgment currently available are specified. Ways of removing existing uncertainties that stand in the way of resolving outstanding issues are suggested. DOE

N82-23623# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. BARROW QUADRANGLE, ALASKA, VOLUME 1 Final Report
Mar. 1981 100 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-000334; GJBX-295-81-Vol-1) Avail: NTIS HC A05/MF A01

From July to August 1980, an airborne high sensitivity gamma ray spectrometer and magnetometer survey over eleven 30 by 10 and one 40 by 10 quadrangles of the Alaskan North Slope were conducted. The results obtained over the Barrow area are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. Complete data listings of both the reduced single record and the reduced averaged record data are given. DOE

N82-23624# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. WAINWRIGHT QUADRANGLE, ALASKA, VOLUME 2 Final Report
Mar. 1981 125 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-000341; GJBX-296-81-Vol-2) Avail: NTIS HC A06/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are given for the survey conducted in the Wainwright area, Alaska. DOE

N82-23625# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY, KENORA QUADRANGLE, MINNESOTA, VOLUME 1 Final Report
Mar. 1981 87 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-001029; GJBX-328-81-Vol-1) Avail: NTIS HC A05/MF A01

During the months of June through October, 1980, Aero Service Division Western Geophysical Company of America conducted an airborne high sensitivity gamma-ray spectrometer and magnetometer survey over eleven (11) 20 x 10 NTMS quadrangles located in the states of Minnesota and Wisconsin and seven (7) 20 x 10 NTMS quadrangles in North and South Dakota. The results obtained over the Kenora map area of Minnesota are discussed. The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms: and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-23626# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. MEADE RIVER QUADRANGLE, ALASKA, VOLUME 2 Final Report
Feb. 1981 173 p
(Contract DE-AC13-76GJ-01664)
(DE82-000340; GJBX-297-81-Vol-2) Avail: NTIS HC A08/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium are given for the Beechey point area, Alaska. DOE

N82-23627# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. TESHEKPUK QUADRANGLE, ALASKA, VOLUME 2 Final Report
Mar. 1981 88 p
(Contract DE-AC13-76GJ-01664)
(DE82-000310; GJBX-298-81-Vol-2) Avail: NTIS HC A05/MF A01

The flight path map, multiparameter profiles, histograms, and anomally maps for uranium, thorium, potassium uranium/potassium, uranium/thorium, and thorium/potassium are given. DOE

N82-23628# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. HARRISON BAY QUADRANGLE, ALASKA, VOLUME 2 Final Report
Feb. 1981 120 p
(Contract DE-AC13-76GJ-016664)
(DE82-000315; GJBX-299-81-Vol-2) Avail: NTIS HC A06/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are given. DOE

N82-23629# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY: BEECHEY PT., QUADRANGLE, ALASKA, VOLUME 2 Final Report
Feb. 1981 76 p
(Contract DE-AC13-76GJ-01664)
(DE82-000309; GJBX-300-81-Vol-2) Avail: NTIS HC A05/MF A01

Aerial survey data are presented including the flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium. DOE

N82-23630# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. POINT LAY QUADRANGLE, ALASKA, VOLUME 2 Final Report
Feb. 1981 101 p
(Contract DE-AC13-76GJ-01664)
(DE82-000308; GJBX-301-81-Vol-2) Avail: NTIS HC A06/MF A01

Data from magnetic and spectral surveys of the Point Lay area, Alaska are given including the flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, and potassium. DOE

N82-23631# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. UTUKIK RIVER QUADRANGLE, ALASKA, VOLUME 2 Final Report
Mar. 1981 208 p
(Contract DE-AC13-76GJ-01664)
(DE82-000316; GJBX-302-81-Vol-2) Avail: NTIS HC A10/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are presented. DOE

N82-23632# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. SAGAVANIRKTOK QUADRANGLE, ALASKA, VOLUME 2 Final Report
Mar. 1981 114 p
(Contract DE-AC13-76GJ-01664)
(DE82-000311; GJBX-306-81-Vol-2) Avail: NTIS HC A06/MF A01

Magnetic and gamma ray spectral data are given including the flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium. DOE

N82-23633# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY: DULUTH QUADRANGLE, MINNESOTA, VOLUME 2 Final Report
Apr. 1981 56 p
(Contract DE-AC13-76GJ-01664)
(DE82-001027; GJBX-330-81-Vol-2) Avail: NTIS HC A04/MF A01

The flight path map, multiparameter profiles, histograms, and anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are included. DOE

N82-23634# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. ROSEAU QUADRANGLE, MINNESOTA, VOLUME 2 Final Report
Apr. 1981 50 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-001025; GJBX-329-81-Vol-2) Avail: NTIS HC A03/MF A01

Multiparameter profiles, histograms, and flight path and anomaly maps are provided for uranium, thorium and potassium deposits. N.W.

N82-23635# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. DEVIL'S LAKE QUADRANGLE, NORTH DAKOTA, VOLUME 1 Final Report
May 1981 98 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004161; GJBX-354-81-Vol-1) Avail: NTIS HC A05/MF A01

During the months of June through October, 1980, an airborne high sensitivity gamma ray spectrometer and magnetometer survey was conducted over eleven 20 X 10 NTMS quadrangles located in the states of Minnesota and Wisconsin and seven 20 x 10 NTMS quadrangles in North and South Dakota. The results obtained over the Devil's Lake map area of North Dakota are discussed. The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-23636# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. DEVIL'S LAKE QUADRANGLE, NORTH DAKOTA, VOLUME 2 Final Report
Apr. 1981 98 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004168; GJBX-354-81-Vol-2) Avail: NTIS HC A05/MF A01

Volume 2 on airborne gamma ray spectrometer and magnetometer surveys contains the flight path map, radiometric multiple parameter stacked profiles, magnetic and ancillary

parameter stacked profiles, histograms, and anomaly maps for uranium, potassium, thorium, uranium/potassium, uranium/thorium, and thorium/potassium. DOE

N82-23637# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. BEMIDJI QUADRANGLE, MINNESOTA, VOLUME 1 Final Report
May 1981 102 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-001032; GJBX-331-81-Vol-1) Avail: NTIS HC A06/MF A01

The results obtained over the Bemidji map area of Minnesota by airborne high sensitivity gamma ray spectrometer and magnetometer surveys are discussed. The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. Complete data listings of both the reduced single record and the reduced averaged record data are also reported. DOE

N82-23638# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. BEMIDJI QUADRANGLE, MINNESOTA, VOLUME 2 Final Report
Mar. 1981 50 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-001026; GJBX-331-81-Vol-2) Avail: NTIS HC A03/MF A01

Aerial surveys of the Bemidji quadrangle, Minnesota are reported. In volume 2 the flight path map, multiparameter profiles, histograms and anomaly maps fo uranium, thorium, potassium, uranium/potassium, uranium/thorium and thorium/potassium are presented. DOE

N82-23639# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. HIBBING QUADRANGLE, MINNESOTA, VOLUME 1 Final Report
Apr. 1981 111 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004159; GJBX-355-81-Vol-1) Avail: NTIS HC A06/MF A01

An airborne high sensitivity gamma-ray spectrometer and magnetometer survey over eleven 20 x 10 NTMS quadrangles located in the states of Minnesota and Wisconsin and seven 20 x 10 NTMS quadrangles in North and South Dakota was conducted. The results obtained over the Hibbing, Minnesota map area are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-23640# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. HIBBING QUADRANGLE, MINNESOTA, VOLUME 2 Final Report
Apr. 1981 138 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004165; GJBX-355-81-Vol-2) Avail: NTIS HC A07/MF A01

The flight path map, radiometric multiple-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, and histograms are presented. Anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are included. DOE

N82-23641# Western Geophysical Co. of America, Houston, Tex. Aero Service Dept.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. ABERDEEN QUADRANGLE, SOUTH DAKOTA, VOLUME 1 Final Report
Apr. 1981 99 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004152; GJBX-357-81-Vol-1) Avail: NTIS HC A05/MF A01

An airborne high sensitivity gamma-ray spectrometer and magnetometer survey over eleven 20 x 10 NTMS quadrangles located in the states of Minnesota and Wisconsin and seven 20 x 10 NTMS quadrangles in North and South Dakota were conducted. The results obtained over the Aberdeen, South Dakota map area are discussed. The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-23642# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. ABERDEEN QUADRANGLE, SOUTH DAKOTA, VOLUME 2 Final Report
Apr. 1981 106 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004164; GJBX-357-81-Vol-2) Avail: NTIS HC A06/MF A01

The flight path map, radiometric and multiple-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, and histograms are presented. Anomaly maps for uranium, thorium, potassium, uranium/potassium, uranium/thorium, and thorium/potassium are included. DOE

N82-23643# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. INTERNATIONAL FALLS QUADRANGLE, MINNESOTA, VOLUME 1 Final Report
Apr. 1981 107 p refs 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004151; GJBX-356-81-Vol-1) Avail: NTIS HC A06/MF A01

Results obtained using an airborne high sensitivity gamma-ray spectrometer and magnetometer to survey the International Falls map area of Minnesota are presented on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps. DOE

N82-23644# Western Geophysical Co. of America, Houston, Tex. Aero Service Div.
AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. INTERNATIONAL FALLS QUADRANGLE, MINNESOTA, VOLUME 2 Final Report
Apr. 1981 104 p 2 Vol.
(Contract DE-AC13-76GJ-01664)
(DE82-004166; GJBX-356-81-Vol-2) Avail: NTIS HC A06/MF A01

The flight path map is presented as well as radiometric multiple-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for uranium, potassium, thorium, uranium/potassium, thorium/potassium, and uranium/thorium. DOE

N82-23645# Geological Survey, Champaign, Ill.
ANALYSES OF NATURAL GAS IN ILLINOIS
Wayne F. Meents 1981 70 p refs Sponsored in part by the Illinois Inst. of Natural Resources
(PB82-124322; IL/SGS/IP-122) Avail: NTIS HC A04/MF A01 CSCL 08D

By the end of 1979, natural gas samples from 2,321 sources in Illinois were analyzed. Major sources of gas samples and the number of samples from those sources include: solution gas from water wells (1,402), gas wells (412), solution gas from oil wells (166); solution gas from oil-filled water supply wells (142), abandoned coal mine vents (60), gas seeps (38), landfill vents (16), and water springs (16). Several methods were used for analysis: 242 early gas samples were analyzed using the Orsat method; 47 samples were checked on a Podbielniak apparatus; the remaining 2,033 were analyzed by gas chromatography. These data are presented as a computerized data base which should be particularly valuable to geologists and geochemists interested in the occurrence and geologic history of oil and gas, or who

wish to assess the potential hazards to humans of certain gaseous emanations. GRA

N82-23646# Geological Survey, Helena, Mont. Water Resources Div.

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1980. VOLUME 1: HUDSON BAY BASIN, MISSOURI RIVER BASIN Annual Water Data Report, 1 Oct. 1979 - 30 Sep. 1980

Jul. 1981 667 p refs Sponsored in cooperation with State of Montana 2 Vol.

(PB82-127713; USGS/WRD/HD-81/087-Vol-1; USGS-WDR-MT-80-1-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 08H

Water resources data for the 1980 water year for Montana consist of records of stage, discharge, and water quality of streams, stage, contents and water quality of lakes and reservoirs, and water levels in wells. Discharge records for 176 gaging stations, stage only records for 1 lake station; 6 lakes and reservoirs, water quality for 118 stations and water levels for 9 observation wells are included. Also included are 141 crest stage partial record stations and 23 smaller reservoirs. GRA

N82-23647# Geological Survey, Helena, Mont. Water Resources Div.

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1980. VOLUME 2: UPPER COLUMBIA RIVER BASIN Annual Water Data Report, 1 Oct. 1979 - 30 Sep. 1980

May 1981 196 p refs Sponsored in part by State of Montana

(PB82-127721; USGS/WRD/HD-81/067-Vol-2; USGS-WDR-MT-80-2) Avail: NTIS HC A09/MF A01 CSCL 08H

Water resources data for the 1980 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. Discharge records are given for 48 gaging stations; stage/contents for 3 lakes and reservoirs; water quality for 22 stations, 2 lakes; water levels for 14 observation wells. Also included are 24 crest-stage partial-record stations and 20 smaller reservoirs. Author (GRA)

N82-23648# Delaware Univ., Newark. Coll. of Marine Studies.

REMOTE SENSING OF OPTICALLY SHALLOW, VERTICALLY INHOMOGENEOUS WATERS: A MATHEMATICAL MODEL

W. D. Philpot and S. G. Ackleson Jun. 1981 26 p refs Presented at the Symp. on Results of 1980 Chesapeake Bay Plume Study, Williamsburg, Va., 21-23 Jan. 1980

(Grant NA80AA-D-00106)

(PB82-129362; NOAA-81100504; DEL-SG-12-81) Avail: NTIS HC A03/MF A01 CSCL 08J

A multiple-layer radiative transfer model of a vertically inhomogeneous, optically shallow water mass is briefly described. This model is directed toward use in remote sensing of water properties. Some preliminary results and qualitative predictions are presented. GRA

N82-23649# California Univ., Berkeley.

CALCULATION OF THE CHEMICAL AND THERMODYNAMIC CONSEQUENCES OF DIFFERENCES BETWEEN FLUID AND GEOSTATIC PRESSURE IN HYDROTHERMAL SYSTEMS Ph.D. Thesis

Carol Jeanne Schnake 1981 89 p

Avail: Univ. Microfilms Order No. 8200267

Because volumes of minerals change negligibly with depth in the crust, and because equilibrium in the fluid requires the fluid components of the mineral to be equal to the stoichiometric sum of the chemical potentials in the fluid phase of the species comprising the components of the mineral, mineral solubilities and univariant phase relations for fluid pressure (P sub f)< geostatic pressure (P sub rk) can be expressed with the aid of an equation of state as a function of temperature and depth along any given geotherm. Although elastic deformation caused by nonhydrostatic stress has a negligible effect on the thermodynamic properties of minerals in the crust, the relative stabilities of minerals at any given depth are highly sensitive to P sub f. Thermodynamic calculations indicate that the solubilities of quartz and other minerals may differ by as much as several orders of magnitude from corresponding solubilities for P sub f = P sub rk at equivalent depths and temperatures. Temperature depth diagrams depicting equilibrium isopleths can be used to assess the impact on phase relations of changes in fluid pressure and/or the thermal regime in the upper crust. Dissert. Abstr.

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N82-23650*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PROCEEDINGS OF THE LOW-COST SOLAR ARRAY WAFERING WORKSHOP

A. D. Morrison 1 Feb. 1982 300 p refs Workshop held in Phoenix, Ariz., 8-10 Jun. 1981

(Contract NAS7-100; DE-AI01-76ET-20356)

(NASA-CR-168847; JPL-Pub-82-9; DOE/JPL-1012-66; NAS 1.26:168847) Avail: NTIS HC A13/MF A01 CSCL 10A

The technology and economics of silicon ingot wafering for low cost solar arrays were discussed. Fixed and free abrasive sawing wire, ID, and multiblade sawing, materials, mechanisms, characterization, and innovative concepts were considered. For individual titles, see N82-23651 through N82-23677.

N82-23651*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

LSA PROJECT PERSPECTIVE OF WAFERING TECHNOLOGY

K. M. Koliwad *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 3-11 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The economics and techniques for eliminating wafering as a part of ingot technology in the production of silicon sheets for photovoltaic applications are considered. Technical progress in both ingot and non-ingot technologies for the low cost solar array project is described in the context of process economics. The critical areas of research in wafering are delineated and their payoff potential discussed. J.D.

N82-23652*# Pennsylvania Univ., Philadelphia.

COMPARISON OF VARIOUS SILICON SAWING METHODS

Martin Wolf *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 13-23 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The technology and economics of four methods of wafering silicon boules of large cross section are described. Slurry sawing using either blades or wires, and fixed abrasive sawing using the ID saw or by the FAST method, having the abrasive attached to wires which are arranged in a blade pack, are considered. The technical performance of each method is evaluated and cost/price estimates are summarized. J.D.

N82-23653*# ARCO Solar, Inc., Chatsworth, Calif.

ARCO SOLAR, INCORPORATED: THE INDUSTRIAL POINT OF VIEW

J. W. Yerkes *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 25-28 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The status of technological developments in silicon wafer

production is summarized. Wafer growing and casting/sawing methods are considered. aba J.D.

N82-23654*# Applied Solar Energy Corp., City of Industry, Calif.

SOME DISCONNECTED SPECULATIONS ON SLICING SILICON

P. A. Iles *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 29-32 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The basic principles for qualifying silicon wafering methods are summarized, and unconventional methods of wafering was discussed. Methods of cleaving analogous to diamond cutting, geological processes employing the expansion of freezing water, and karate chops are touched upon. J.D.

N82-23655*# Silicon Technology Corp., Oakland, N. J.

ID WAFERING TECHNOLOGY

Peter Aharonyan *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 35-46 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

Improvements in ID saws leading to lower costs for producing silicon wafers for solar cells are described. The relationships between crystal size and blade size and between the length of time it takes to slice a wafer and wafer thickness are discussed. The influence of ingot production methods on wafering performance is considered. A cost sensitivity analysis of slicing a 10 cm square ingot and economic analyses of slicing a four inch and a six inch ingot are presented. A wafering cost model based on the IPEG 2 is given. J.D.

N82-23656*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ALLOWABLE SILICON WAFER THICKNESS VERSUS DIAMETER FOR INGOT ROTATION ID WAFERING

C. P. Chen and M. H. Leipold *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 47-60 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

Inner diameter (ID) wafering of ingot rotation reduce the ID saw blade diameter was investigated. The blade thickness can be reduced, resulting in minimal kerf loss. However, significant breakage of wafers occurs during the rotation wafering as the wafer thickness decreases. Fracture mechanics was used to develop an equation relating wafer thickness, diameter and fracture behavior at the point of fracture by using a model of a wafer, supported by a center column and subjected to a cantilever force. It is indicated that the minimum allowable wafer thickness does not increase appreciably with increasing wafer diameter and that fracture through the thickness rather than through the center supporting column limits the minimum allowable wafer thickness. It is suggested that the minimum allowable wafer thickness can be reduced by using a vacuum chuck on the wafer surface to enhance cleavage fracture of the center core and by using < 111> ingots. E.A.K.

N82-23657*# Kayex Corp., Rochester, N. Y.

CURRENT ECONOMIC AND SENSITIVITY ANALYSIS FOR ID SLICING OF 4 INCH AND 6 INCH DIAMETER SILICON INGOTS FOR PHOTOVOLTAIC APPLICATIONS

E. G. Roberts and C. Moody Johnson *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 61-77 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The economics and sensitivities of slicing large diameter silicon ingots for photovoltaic applications were examined. Current economics and slicing add on cost sensitivities are calculated using variable parameters for blade life, slicing yield, and slice cutting speed. It is indicated that cutting speed has the biggest impact on slicing add on cost, followed by slicing yield, and by blade life as the blade life increases. E.A.K.

N82-23658*# IBM Watson Research Center, Yorktown Heights, N.Y.

EFFECT OF LUBRICANT ENVIRONMENT ON SAW DAMAGE IN SILICON WAFERS

T. S. Kuan, K. K. Shih, J. A. vanVechten, and W. A. Westdorp (IBM, Hopewell Junction, N.Y.) *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 81-88 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The chemomechanical effect of lubricant environments on the inner diameter (ID) sawing induced surface damage in Si wafers was tested for four different lubricants: water, dielectric oil, and two commercial cutting solutions. The effects of applying different potential on Si crystals during the sawing were also tested. It is indicated that the number and depth of surface damage are sensitive to the chemical nature of the saw lubricant. It is determined that the lubricants that are good catalysts for breaking Si bonds can dampen the out of plane blade vibration more effectively and produce less surface damage. Correlations between the applied potential and the depth of damage in the dielectric oil and one of the commercial cutting solutions and possible mechanisms involved are discussed. E.A.K.

N82-23659*# Illinois Univ. at Chicago Circle, Chicago.

INFLUENCE OF FLUIDS ON THE ABRASION OF SILICON BY DIAMOND

Steven Danyluk *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 89-100 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

Silicon wafers ((100)-p-type) were abraded at room temperature in acetone, absolute ethanol and water by a pyramid diamond and the resulting groove depth was measured as a function of normal force on the diamond and the absorbed fluids, while all other experimental conditions were held constant. The groove depth rates are in the ratio of 1:2:3 for water, absolute ethanol, and acetone, respectively, for a constant normal force. The groove depth rate is lower when the normal force is decreased. The silicon abraded in the presence of water was chipped as expected for a classical brittle material while the surfaces abraded in the other two fluids showed ductile ploughing as the main mechanism for silicon removal. E.A.K.

N82-23660*# General Electric Co., Worthington, Ohio.

THE USES OF MAN-MADE DIAMOND IN WAFERING APPLICATIONS

Daniel B. Fallon *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 101-109 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

The continuing, rapid growth of the semiconductor industry requires the involvement of several specialized industries in the development of special products geared toward the unique requirements of this new industry. A specialized manufactured diamond to meet various material removal needs was discussed. The area of silicon wafer slicing has presented yet anothr challenge and it is met most effectively. The history, operation, and performance of Man-Made diamond and particularly as applied to silicon wafer slicing is discussed. Product development is underway to come up with a diamond specifically for sawing silicon wafers on an electroplated blade. E.A.K.

N82-23661*# Crystal Systems, Inc., Salem, Mass.

WIRE BLADE DEVELOPMENT FOR FIXED ABRASIVE SLICING TECHNIQUE (FAST) SLICING

Chandra P. Khattak, Frederick Schmid, and Maynard B. Smith *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 111-123 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

A low cost, effective slicing method is essential to make ingot technology viable for photovoltaics in terrestrial applications. The fixed abrasive slicing technique (FAST) combines the advantages of the three commercially developed techniques. In its development stage FAST demonstrated cutting effectiveness of 10 cm and 15 cm diameter workpieces. Wire blade development is still the critical element for commercialization of FAST technology. Both impregnated and electroplated wire blades have been developed; techniques have been developed to fix diamonds only in the cutting edge of the wire. Electroplated wires show the most near term promise and this approach is emphasized.

With plated wires it has been possible to control the size and shape of the electroplating, it is expected that this feature reduces kerf and prolongs the life of the wirepack. E.A.K.

N82-23662*# Hoffman (P. R.) Co., Carlisle, Pa.
DESIGN AND USE OF MULTIPLE BLADE SLURRY SAWING IN A PRODUCTION ATMOSPHERE
F. Pelzer Lynah, Jr. and Jack B. Ross *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 133-139 (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The technique and uses of the multiple blade slurry (MBS) saw are considered. Multiple bands of steel are arranged in a frame and the frame is reciprocated with the steel bands to a workpiece, while simultaneously applying abrasive at the point of contact. The blades wear slots in the workpiece and progress through the piece resulting in several parts of wafers. The transition to MBA from diamond slicing is justified by savings resulting from minimized kerf losses, minimized subsurface damage, and improved surface quality off the saw. This allows wafering much closer to finished thickness specifications. The current state of the art MBS technology must be significantly improved if the low cost solar array (LSA) goals are to be attained. It is concluded that although MBS will never be the answer to every wafering requirement, the economical production of wafers to LSA project specifications will be achieved. E.A.K.

N82-23663*# Bremen Univ., (West Germany).
KINEMATICAL AND MECHANICAL ASPECTS OF WAFER SLICING
P. Guenther Werner *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 141-157 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

Some recently achieved results concerning the technological fundamentals of slurry sawing are presented. The specific material removal process and the related kinematic and geometric contact conditions between workpiece and saw blade are described. The result of a functional description of the slurry sawing process is presented, expressing the main process criteria, such as infeed per stroke, specific removal rate, specific tool wear, and vertical stroke intensity, in terms of the dominating process parameters, such as stroke length, width of workpiece, stroke frequency, specific cutting force and slurry specification. A.R.H.

N82-23664*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CORROSION INHIBITORS FOR WATER-BASE SLURRY IN MULTIBLADE SAWING
C. P. Chen and T. P. ODonnell *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 159-174 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The use of a water-base slurry instead of the standard PC oil vehicle was proposed for multiblade sawing (MBS) silicon wafering technology. Potential cost savings were considerable; however, significant failures of high-carbon steel blades were observed in limited tests using a water-based slurry during silicon wafering. Failures were attributed to stress corrosion. A specially designed fatigue test of 1095 steel blades in distilled water with various corrosion inhibitor solutions was used to determine the feasibility of using corrosion inhibitors in water-base MBS wafering. Fatigue tests indicate that several corrosion inhibitors have significant potential for use in a water-base MBS operation. Blade samples tested in these specific corrosion-inhibitor solutions exhibited considerably greater lifetime than those blades tested in PC oil. A.R.H.

N82-23665*# Applied Solar Energy Corp., City of Industry, Calif.
FIELD EXPERIENCE WITH VARIOUS SLICING METHODS
H. I. Yoo *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 179-185 Sponsored in part by DOE (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

Wafer slicing using internal diameter (ID) saw, multiblade slurry (MBS) saw and multiwire slurry (MWS) saw techniques were evaluated. Wafer parameters such as bow, taper, and roughness which may not be important factors for solar cell fabrication, were considerably better for ID saw than those of the MBS and MWS saw. Analysis of add-on slicing cost indicated that machine productivity seems to be a major limiting factor for ID saw, while expendible material costs are a major factor for both MBS and MWS saw. Slicing experience indicated that the most important factors controling final wafer cost are: (1) silicon cost (wafer thickness + kerf loss); (2) add-on slicing cost, and (3) mechanical yield. There is a very strong interaction between these parameters, suggesting a necessity of optimization of these parameters. A.R.H.

N82-23666*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOME TRADEOFFS IN INGOT SHAPING AND PRICE OF SOLAR PHOTOVOLTAIC MODULES
Taher Daud *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 187-196 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

Growth of round ingots is cost-effective for sheets but leaves unused space when round cells are packed into a module. This reduces the packing efficiency, which approaches 95% for square cells, to about 78% and reduces the conversion efficiency of the module by the same ratio. Shaping these ingots into squares with regrowth of cut silicon improves the packing factor, but increases growth cost. The cost impact on solar cell modules was determined by considering shaping ingots in stages from full round to complete square. The sequence of module production with relevant price allocation guidelines is outlined. The severe penalties in add-on price due to increasing slice thickness and kerf are presented. Trade-offs between advantages of recycling silicon and shaping costs are developed for different slicing scenarios. It is shown that shaping results in cost saving of up to 21% for a 15 cm dia. ingot. A.R.H.

N82-23667*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SENSITIVITY ANALYSIS OF ADD-ON PRICE ESTIMATE FOR SELECT SILICON WAFERING TECHNOLOGIES
Anant R. Mokashi *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 197-209 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The cost of producing wafers from silicon ingots is a major component of the add-on price of silicon sheet. Economic analyses of the add-on price estimates and their sensitivity internal-diameter (ID) sawing, multiblade slurry (MBS) sawing and fixed-abrasive slicing technique (FAST) are presented. Interim price estimation guidelines (IPEG) are used for estimating a process add-on price. Sensitivity analysis of price is performed with respect to cost parameters such as equipment, space, direct labor, materials (blade life) and utilities, and the production parameters such as slicing rate, slices per centimeter and process yield, using a computer program specifically developed to do sensitivity analysis with IPEG. The results aid in identifying the important cost parameters and assist in deciding the direction of technology development efforts. A.R.H.

N82-23668*# Semix, Inc., Gaithersburg, Md.
WAFERING ECONOMIES FOR INDUSTRIALIZATION FROM A WAFER MANUFACTURER'S VIEWPOINT
Thomas P. Rosenfield and Frank P. Fuerst *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 211-229 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The key technical limitations which inhibit the lowering of value-added costs for state-of-the-art wafering techniques are assessed. From the best experimental results to date, a projection was made to identify those parts of each system which need to be developed in order to meet or improve upon the value-added cost reduction necessary for $0.70/Wp photovoltaics modules. A.R.H.

N82-23669*# Crystal Systems, Inc., Salem, Mass.
OVERVIEW OF A NEW SLICING METHOD: FIXED ABRASIVE SLICING TECHNIQUE (FAST)
Frederick Schmid, Maynard B. Smith, and Chandra P. Khattak

In JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 233-241 refs Sponsored in part by DOE (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The fixed abrasive slicing technique (FAST) was developed to slice silicon ingots more effectively. It was demonstrated that 25 wafers/cm can be sliced from 10 cm diameter and 19 wafers/cm from 15 cm diameter ingots. This was achieved with a combination of machine development and wire-blade development programs. Correlation was established between cutting effectiveness and high surface speeds. A high speed slicer was designed and fabricated for FAST slicing. Wirepack life of slicing three 10 cm diameter ingots was established. Electroforming techniques were developed to control widths and prolong life of wire-blades. Economic analysis indicates that the projected add-on price of FAST slicing is compatible with the DOE price allocation to meet the 1986 cost goals. M.G.

N82-23670*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYSTEM FOR SLICING WAFERS
In its Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 243-248 (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 20D

A newly patented process for slicing silicon wafers that has distinct advantages over methods now widely used is described. The primary advantage of the new system is that it allows the efficient slicing of a number of ingots simultaneously at high speed. The cutting action is performed mechanically, most often with diamond particles that are transported to the cutting zone by a fluid vehicle or have been made an integral part of the blade by plating or impregnation. The new system uses a multiple or ganged band saw, arranged and spaced so that each side, or length, segment of a blade element, or loop, provides a cutting function. Each blade is maintained precisely in position by guides as it enters and leaves each ingot. The cutting action is performed with a conventional abrasive slurry composed of diamond grit suspended in an oil- or water-based vehicle. The distribution system draws the slurry from the supply reservoir and pumps it to the injection tubes to supply it to each side of each ingot. A flush system is provided at the outer end of the work-station zone. In order to reduce potential damage, a pneumatically driven flushing fluid is provided. R.J.F.

N82-23671*# Scomac, Inc., LeRoy, N.Y.
DIAMOND SHEET: A NEW DIAMOND TOOL MATERIAL
Charles R. Mackey *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 249-252 (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

Diamond sheet is termed a diamond tool material because it is not a cutting tool, but rather a new material from which a variety of different tools may be fabricated. In appearance and properties, it resembles a sheet of copper alloy with diamond abrasive dispersed throughout it. It is capable of being cut, formed, and joined by conventional methods, and subsequently used for cutting as a metal bonded diamond tool. Diamond sheet is normally made with industrial diamond as the abrasive material. The metal matrix in diamond sheet is a medium hard copper alloy which has performed well in most applications. This alloy has the capability of being made harder or softer if specific cutting conditions require it. Other alloys have also been used including a precipitation hardened aluminum alloy with very free cutting characteristics. The material is suitable for use in a variety of cutting, surfacing, and ring type tools, as well as in such mundane items as files and sandpaper. It can also be used as a bearing surface (diamond to diamond) and in wear resistant surfaces. R.J.F.

N82-23672*# Silicon Technology Corp., Oakland, N. J.
ID SLICING AND THE AUTOMATED FACTORY
T. Lewandowski *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 253-258 (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The automation of the slicing system utilizing internal-diameter saws for the production of the silicon wafers used in solar arrays is discussed. It is argued that saw productivity can be increased by reducing silicon waste, decreasing usage of consumables, keeping the saw slicing, and increasing the cutting speed. Several machine enhancements utilizing automatic control are discussed. The need for record keeping to anticipate maintenance operations is noted, and a digital serial communication interface with the microprocessor-based saws is recommended. Distributed control of the manufacturing process is discussed in detail, and is recommended as a method for increasing productivity. R.J.F.

N82-23673*# Applied Solar Energy Corp., City of Industry, Calif.
WAFERING INSIGHT PROVIDED BY THE ODE METHOD
S. I. Soclof and P. A. Iles *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 259-266 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The orientation-dependent etching method of slicing was investigated to see if it could be used to form more slices from high quality silicon crystals than can be achieved by mechanical slicing methods. Orientation-dependent slicing uses preferential etching down narrow slots in a silicon slab on form slices. The method has several possible advantages including high slicing yield (sq m/kg), plane parallel, thin slices, ready for processing and the chance of high throughput and low costs. There are limitations in the need for simple crystals, and in restricted depth of slicing. M.G.

N82-23674*# Texas Instruments, Inc., Sherman.
EXIT CHIPPING IN ID SAWING OF SILICON CRYSTALS
L. D. Dyer *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 269-277 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The processes involved in exit chipping which may occur in the internal diameter diamond sawing of silicon crystals were examined. An interpretation of chipping observations is given in terms of crack propagation as acted upon by the sawing stresses. Since the exit chips are roughly parallel to saw marks, the general locus of the crack must be determined by contact stresses although the exact locus depends on already existing subfractures located in the kerf region which are caused by more than one abrasive particle. The crack starts at either edge since these are weak areas in flexure. In the more extensive 'saw fracture', the fracture plane often changes part-way across the slice to be other than parallel to the saw mark because the speed of the crack accelerates beyond the speed of the blade travel; i.e., outstrips the advance of the contact stress field. The influences of various external factors on the opening of the crack are divided into two types: factors that wedge the crack apart and those that bend the slice away from the crystal. From a consideration of these factors, conditions for minimizing exit chipping are defined. M.G.

N82-23675*# Argonne National Lab., Ill.
FUNDAMENTAL STUDIES OF THE SOLID-PARTICLE EROSION OF SILICON
J. L. Routbort and R. O. Scattergood *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 279-288 refs (For primary document see N82-23650 14-44)
Avail: NTIS HC A13/MF A01 CSCL 10A

The predictions of the theories of solid-particle erosion of brittle materials are compared to experimental results of studies in which angular Al2O3 particles with mean diameters D of 23 to 270 microns are used to erode (111) surfaces of silicon single crystals at impact angles alpha from 20 to 90 deg and velocities v from 30 to 150 m/s. The description of the steady state erosion rate by a power law, delta W varies directly as (v sin alpha)(n)D(m) must be modified to include threshold and plasticity effects. Furthermore the velocity exponent n depends on D. Results using abrasives of different sizes mixed together can be explained using a logarithmic-normal distribution. The results of transient experiments can be used to explain the synergistic effects which are observed using a biomodal distribution of abrasives. Author

N82-23676*# International Business Machines Corp., Hopewell Junction, N. Y.
PRE- AND POST-ANNEALING OF MECHANICAL DAMAGE

IN SILICON WAFERS

G. H. Schwottke *In* JPL Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 289-303 refs (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

Basic properties of mechanical damage in silicon consisting of cracks and abrasion were studied using transmission electron microscopy. The crystallographic structure of mechanical damage was determined before and after high temperature annealing. The main findings include that stresses in silicon around crack tips are not plastically relieved at room temperature and that abrasion at room temperature introduces shear loops into the silicon. It was also found that cracks of micron size can be annealed out, specifically, if cleavage occurs on 111 planes. The healing products of such cracks are 60 deg and 90 deg dislocations. Submicron cracks transform into stacking faults during annealing. Likewise high concentrations of shear loops due abrasion were found to anneal into stacking faults. A one to one correlation between surface areas containing small cracks and stacking faults was made. Measurements of damage removal on silicon surfaces through chemical-mechanical etching techniques are presented. It is shown that silicon dioxide repolishes damaged silicon surfaces most effectively. M.G.

N82-23677*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

STATUS OF SEMI'S SOLAR-GRADE SUBSTRATE STANDARDS

Brian D. Gallagher *In its* Proc. of the Low-Cost Solar Array Wafering Workshop 1 Feb. 1982 p 305-308 (For primary document see N82-23650 14-44)

Avail: NTIS HC A13/MF A01 CSCL 10A

A proposal for a standard specifications listing covering requirements for silicon wafers used in solar cell manufacturing is outlined. The specific contents of the general requirements specifications include: ordering information; dimensions and permissible variations; material and manufacture; physical parameters; sampling; test methods; certification; and packaging and marking. M.G.

N82-23678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PARAMETRIC PERFORMANCE ANALYSIS OF STEAM-INJECTED GAS TURBINE WITH A THERMIONIC-ENERGY-CONVERTER-LINED COMBUSTOR

Yung K. Choo and Raymond K. Burns Feb. 1982 21 p refs (NASA-TM-82736; E-1048; NAS 1.15:82736) Avail: NTIS HC A02/MF A01 CSCL 10B

The performance of steam-injected gas turbines having combustors lined with thermionic energy converters (STIG/TEC systems) was analyzed and compared with that of two baseline systems; a steam-injected gas turbine (without a TEC-lined combustor) and a conventional combined gas turbine/steam turbine cycle. Common gas turbine parameters were assumed for all of the systems. Two configurations of the STIG/TEC system were investigated. In both cases, steam produced in an exhaust-heat-recovery boiler cools the TEC collectors. It is then injected into the gas combustion stream and expanded through the gas turbine. The STIG/TEC system combines the advantage of gas turbine steam injection with the conversion of high-temperature combustion heat by TEC's. The addition of TEC's to the baseline steam-injected gas turbine improves both its efficiency and specific power. Depending on system configuration and design parameters, the STIG/TEC system can also achieve higher efficiency and specific power than the baseline combined cycle. Author

N82-23679*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF LIGHTNING ACCOMMODATION SYSTEMS FOR WIND-DRIVEN TURBINE ROTORS Final Report

H. Bankaitis Mar. 1982 49 p refs

(Contract DE-AI01-76ET-20320)

(NASA-TM-82784; E-1116; DOE/NASA/20320-37; NAS 1.15:82784) Avail: NTIS HC A03/MF A01 CSCL 10B

Wind-driven turbine generators are being evaluated as an alternative source of electric energy. Areas of favorable location for the wind-driven turbines (high wind density) coincide with areas of high incidence of thunderstorm activity. These locations, coupled with the 30-m or larger diameter rotor blades, make the wind-driven turbine blades probable terminations for lightning strikes. Several candidate systems of lightning accommodation for composite-structural-material blades were designed and their effectiveness evaluated by submitting the systems to simulated lightning strikes. The test data were analyzed and system design were reviewed on the basis of the analysis. T.M.

N82-23680# Northrup, Inc., Hutchins, Tex.

SECOND GENERATION HELIOSTAT DEVELOPMENT FOR SOLAR CENTRAL RECEIVER SYSTEMS. VOLUME 4, APPENDICES F-J: CONTROL SOFTWARE TEST RESULTS MANUFACTURING PILE INSTALLATION PILE COATINGS Final Report, 16 Jul. 1979 - 31 Mar. 1981

Mar. 1981 275 p Sponsored by DOE Prepared in cooperation with Bechtel National, Inc., San Francisco, Calif. and Booz-Allen and Hamilton, Inc., Cleveland, Ohio

(SAND-81-8178-Vol-4) Avail: NTIS HC A12/MF A01

Support documentation for a second generation heliostat project is presented. Flowcharts of control software are included. Numerical and graphic test results are provided. Project management information is also provided. N.W.

N82-23681# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

SOLAR ENERGY LEGAL BIBLIOGRAPHY SECOND UPDATE

Stephen Weiner May 1981 94 p

(Contract EG-77-C-01-4042)

(SERI/TR-744-876) Avail: NTIS HC A05/MF A01

Approximately 100 publications were abstracted for their legal and policy content with respect to solar energy. Emphasis was on legal barriers and incentives to solar energy development. Subject arrangement covers 24 categories. An author index is included. N.W.

N82-23682# Pacific Northwest Lab., Richland, Wash.

FUEL CONSERVATION BY THE APPLICATION OF SPILL PREVENTION AND FAIL-SAFE ENGINEERING (A GUIDELINE MANUAL) Final Report

J. L. Goodier, R. J. Siclari, and P. A. Garrity Jun. 1981 345 p refs

(Contracts AC06-76-RL0-1830; EY-76-C-06-1830)

Avail: NTIS HC A15/MF A01

Spill prevention procedures are provided for maintaining a spill free plant during the transportation, transfer, storage and processing of petroleum products. The manual can be used to prevent spills of materials other than fuel oil. Special emphasis is given to failsafe engineering as an approach to preventing spills from the predominant cause-human failure. S.L.

N82-23683# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

A DAILY RADIATION MODEL FOR USE IN THE SIMULATION OF PASSIVE SOLAR BUILDINGS

Sanford Sillman and David Wortman Apr. 1981 6 p refs Presented at the AS/ISES Conf. and Exposition, Philadelphia, 26-30 May 1981

(Contract EG-77-C-01-4042)

(SERI/TP-721-1137) Avail: NTIS HC A02/MF A01

A model is presented to characterize solar radiation with just three input parameters for each day. This compressed daily radiation data may be used in place of hourly data in simulations of passive solar buildings. This method is tested with the SUNCAT passive simulation. Global horizontal and direct normal radiation data are input using the compressed daily form instead of by hour. Simulation results are found to be comparable to results based on hourly radiation data. Author

N82-23684*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

WIND TURBINE DYNAMICS

Robert W. Thresher, ed. (Oregon State Univ., Corvallis) May 1981 422 p refs Workshop held in Cleveland 24-26 Feb. 1981 Sponsored in part by DOE

(NASA-CP-2185; NAS 1.55:2185; CONF-81-226;

SERI/CP-635-1238) Avail: NTIS HC A18/MF A01 CSCL 10B

Recent progress in the analysis and prediction of the dynamic behavior of wind turbine generators is discussed. The following areas were addressed: (1) the adequacy of state of the art analysis tools for designing the next generation of wind power systems; (2) the use of state of the art analysis tools designers; and (3) verifications of theory which might be lacking or inadequate. Summaries of these informative discussions as well as the questions and answers which followed each paper are documented in the proceedings. For individual titles, see N82-23685 through N82-23733.

N82-23685*# Oregon State Univ., Corvallis. Dept. of Mechanical Engineering.

AERODYNAMIC POTPOURRI

Robert E. Wilson *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 3-7 refs (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

Aerodynamic developments for vertical axis and horizontal axis wind turbines are given that relate to the performance and aerodynamic loading of these machines. Included are: (1) a fixed wake aerodynamic model of the Darrieus vertical axis wind turbine; (2) experimental results that suggest the existence of a laminar flow Darrieus vertical axis turbine; (3) a simple aerodynamic model for the turbulent windmill/vortex ring state of horizontal axis rotors; and (4) a yawing moment of a rigid hub horizontal axis wind turbine that is related to blade coning.

Author

N82-23686*# Toledo Univ., Ohio. Dept. of Mechanical Engineering.

AERODYNAMIC PERFORMANCE PREDICTION OF HORIZONTAL AXIS WIND TURBINES

D. R. Jeng, T. G. Keith, and A. Aliakbarkhanafjeh *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 9-18 refs (For primary document see N82-23684 14-44)

(Contract NCC3-5)

Avail: NTIS HC A18/MF A01 CSCL 10B

A new method for calculating the aerodynamic performance of horizontal axis wind turbines is described. The method, entitled the helical vortex method, directly calculates the local induced velocity due to helical vortices that originate at the rotor blade. Furthermore, the method does not require a specified circulation distribution. Results of the method are compared to similar results obtained from Wilson PROP code methods as well as to existing experimental data taken from a Mod-O wind turbine. It is shown that results of the proposed method agree well with experimental values of the power output both near cut-in and at rated wind speeds. Further, it is found that the method does not experience some of the numerical difficulties encountered by the PROP code when run at low wind velocities. Author

N82-23687*# Institut de Recherche de l'Hydro-Quebec, Varennes.

DOUBLE-MULTIPLE STREAMTUBE MODEL FOR DARRIEUS IN TURBINES

Ion Paraschivoiu *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 19-25 refs Sponsored in part by IREQ (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

An analytical model is proposed for calculating the rotor performance and aerodynamic blade forces for Darrieus wind turbines with curved blades. The method of analysis uses a multiple-streamtube model, divided into two parts: one modeling the upstream half-cycle of the rotor and the other, the downstream half-cycle. The upwind and downwind components of the induced velocities at each level of the rotor were obtained using the principle of two actuator disks in tandem. Variation of the induced velocities in the two parts of the rotor produces larger forces in the upstream zone and smaller forces in the downstream zone. Comparisons of the overall rotor performance with previous methods and field test data show the important improvement obtained with the present model. The calculations were made using the computer code CARDAA developed at IREQ. The double-multiple streamtube model presented has two major advantages: it requires a much shorter computer time than the three-dimensional vortex model and is more accurate than multiple-streamtube model in predicting the aerodynamic blade loads. Author

N82-23688*# United Technologies Corp., East Hartford, Conn. Aeromechanics Research Section.

THE UTRC WIND ENERGY CONVERSION SYSTEM PERFORMANCE ANALYSIS FOR HORIZONTAL AXIS WIND TURBINES (WECSPER)

T. Alan Egolf and Anton J. Landgrebe *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 27-34 refs (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

The theory for the UTRC Energy Conversion System Performance Analysis (WECSPER) for the prediction of horizontal axis wind turbine performance is presented. Major features of the analysis are the ability to: (1) treat the wind turbine blades as lifting lines with a prescribed wake model; (2) solve for the wake-induced inflow and blade circulation using real nonlinear airfoil data; and (3) iterate internally to obtain a compatible wake transport velocity and blade loading solution. This analysis also provides an approximate treatment of wake distortions due to tower shadow or wind shear profiles. Finally, selected results of internal UTRC application of the analysis to existing wind turbines and correlation with limited test data are described.

Author

N82-23689*# Young Energy Systems, Dennisport, Mass.

THE VELOCITY FIELD OF A SYSTEM OF UNSTEADY CYCLOIDAL VORTICIES

Bernard J. Young *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 35-40 refs (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

An essential difference between two-dimensional and three-dimensional models of cycloidal rotors, the presence of unsteady trailing cycloidal vorticies in the wake, was studied. The velocity induced by these vorticies is the primary mechanism producing flow retardation for low span/radius ratio, finite blade number rotors. Results of using idealized rigid wake model of finite blade cycloidal rotors to investigate some cycloidal rotor problems are presented. Author

N82-23690*# Wichita State Univ., Kans.

ANALYTICAL STUDIES OF NEW AIRFOILS FOR WIND TURBINES

W. H. Wentz, Jr. and J. T. Calhoun *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 41-49 refs (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

Computer studies were conducted to analyze the potential gains associated with utilizing new airfoils for large wind turbine rotor blades. Attempts to include 3-dimensional stalling effects were inconclusive. It is recommended that blade pressure measurements be made to clarify the nature of blade stalling. It is also recommended that new laminar flow airfoils be used as rotor blade sections. Author

N82-23691*# University of Western Ontario, London. Dept. of Engineering Science.

ON THE WAKE OF A DARRIEUS TURBINE

T. E. Base, P. Phillips, G. Robertson, and E. S. Nowak *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 51-66 refs (For primary document see N82-23684 14-44)

Avail: NTIS HC A18/MF A01 CSCL 10B

The theory and experimental measurements on the aerodynamic decay of a wake from high performance vertical axis wind turbine are discussed. In the initial experimental study, the wake downstream of a model Darrieus rotor, 28 cm diameter and a height of 45.5 cm, was measured in a Boundary Layer Wind Tunnel. The wind turbine was run at the design tip speed ratio of 5.5. It was found that the wake decayed at a slower rate with distance downstream of the turbine, than a wake from a screen with similar troposkein shape and drag force characteristics as the Darrieus rotor. The initial wind tunnel results indicated that the vertical axis wind turbines should be spaced at least forty diameters apart to avoid mutual power depreciation greater than ten per cent. Author

N82-23692*# Sandia Labs., Albuquerque, N. Mex.
RECENT DARRIEUS VERTICAL AXIS WIND TURBINE AERODYNAMICAL EXPERIMENTS AT SANDIA NATIONAL LABORATORIES
Paul C. Klimas *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 67-76 refs (For primary document see N82-23684 14-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A18/MF A01 CSCL 10B

Experiments contributing to the understanding of the aerodynamics of airfoils operating in the vertical axis wind turbine (VAWT) environment are described. These experiments are ultimately intended to reduce VAWT cost of energy and increase system reliability. They include chordwise pressure surveys, circumferential blade acceleration surveys, effects of blade camber, pitch and offset, blade blowing, and use of sections designed specifically for VAWT application. Author

N82-23693*# Purdue Univ., Lafayette, Ind.
PERFORMANCE OF WIND TURBINES IN A TURBULENT ATMOSPHERE
R. M. Sundar and J. P. Sullivan *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 79-86 refs Sponsored in part by DOE (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The effect of atmospheric turbulence on the power fluctuations of large wind turbines was studied. The significance of spatial non-uniformities of the wind is emphasized. The turbulent wind with correlation in time and space is simulated on the computer by Shinozukas method. The wind turbulence is modelled according to the Davenport spectrum with an exponential spatial correlation function. The rotor aerodynamics is modelled by simple blade element theory. Comparison of the spectrum of power output signal between 1-D and 3-D turbulence, shows the significant power fluctuations centered around the blade passage frequency. Author

N82-23694*# Oregon State Univ., Corvallis. Dept. of Mechanical Engineering.
WIND RESPONSE CHARACTERISTICS OF HORIZONTAL AXIS WIND TURBINES
R. W. Thresher, W. E. Holley, and N. Jafarey *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 87-99 refs (For primary document see N82-23684 14-44)
(Contract DE-AT06-79ET-23144)
Avail: NTIS HC A18/MF A01 CSCL 10B

It was the objective of the work reported here, and in the companion paper [1]. A broader examination of wind turbine dynamic response to turbulence, and attempts to ascertain the features of turbulence that wind turbines are most sensitive to were made. A statistical description of the wind input including all three wind components and allowing linear wind gradients across the rotor disk, was used together with quasi-static aerodynamic theory and an elementary structural model involving only a few degrees of freedom. The idea was to keep the turbine model simple and show the benefits of this type of statistical wind representation before attempting to use a more complex turbine model. As far as possible, the analysis was kept in the simplest form, while still preserving key physical responses.
Author

N82-23695*# Oregon State Univ., Corvallis. Dept. of Mechanical Engineering.
WIND TURBULENCE INPUTS FOR HORIZONTAL AXIS WIND TURBINES
W. E. Holley, R. W. Thresher, and S.-R. Lin *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 101-112 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Wind turbine response characteristics in the presence of atmospheric turbulence was predicted using two major modeling steps. First, the important atmospheric sources for the force excitations felt by the wind turbine system were identified and characterized. Second, a dynamic model was developed which describes how these excitations are transmitted through the structure and power train. The first modeling step, that of quantifying the important excitations due to the atmospheric turbulence was established. The dynamic modeling of the second step was undertaken separately. Author

N82-23696*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATIONS OF THE DOE/NASA WIND TURBINE ENGINEERING INFORMATION SYSTEM
Harold E. Neustadter and David A. Spera *In its* Wind Turbine Dyn. May 1981 p 113-120 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A statistical analysis of data obtained from the Technology and Engineering Information Systems was made. The systems analyzed consist of the following elements: (1) sensors which measure critical parameters (e.g., wind speed and direction, output power, blade loads and component vibrations); (2) remote multiplexing units (RMUs) on each wind turbine which frequency-modulate, multiplex and transmit sensor outputs; (3) on-site instrumentation to record, process and display the sensor output; and (4) statistical analysis of data. Two examples of the capabilities of these systems are presented. The first illustrates the standardized format for application of statistical analysis to each directly measured parameter. The second shows the use of a model to estimate the variability of the rotor thrust loading, which is a derived parameter. Author

N82-23697*# Rockwell International Corp., Golden, Colo.
AN OVERVIEW OF FATIGUE FAILURES AT THE ROCKY FLATS WIND SYSTEM TEST CENTER
C. A. Waldon *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 121-128 ref (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Potential small wind energy conversion (SWECS) design problems were identified to improve product quality and reliability. Mass produced components such as gearboxes, generators, bearings, etc., are generally reliable due to their widespread uniform use in other industries. The likelihood of failure increases, though, in the interfacing of these components and in SWECS components designed for a specific system use. Problems relating to the structural integrity of such components are discussed and analyzed with techniques currently used in quality assurance programs in other manufacturing industries. Author

N82-23698*# DAF Indal Ltd., Mississauga (Ontario).
PERFORMANCE TESTING OF A 50 kW VAWT IN A BUILT-UP ENVIRONMENT
Lawrence A. Schienbein *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 129-138 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The results of performance tests of a DAF Indal 50 kW vertical axis wind turbine are presented. Results of limited free stream turbulence and vertical wind shear measurements at the site are also presented. The close agreement between measured and predicted energy outputs, required to verify the wind turbine power output performance relationship, was not attained. A discussion is presented of factors that may have contributed to the lack of better agreement. Author

N82-23699*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CALCULATION OF GUARANTEED MEAN POWER FROM WIND TURBINE GENERATORS
David A. Spera *In its* Wind Turbine Dyn. May 1981 p 139-150 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A method for calculating the 'guaranteed mean' power output of a wind turbine generator is proposed. The term 'mean power' refers to the average power generated at specified wind speeds during short-term tests. Correlation of anemometers, the method of bins for analyzing non-steady data, the PROP Code for predicting turbine power, and statistical analysis of deviations in test data from theory are discussed. Guaranteed mean power density for the Clayton Mod-0A system was found to be 8 watts per square meter less than theoretical power density at all power levels, with a confidence level of 0.999. This amounts to 4 percent of rated power. Author

N82-23700*# Browning Engineering Corp., Hanover, N.H.
THE HYDRAULIC WINDMILL
James A. Browing *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 151-154 (For primary document see N82-23684 14-44)
(Contract DE-FG01-80IR-10320)
Avail: NTIS HC A18/MF A01 CSCL 10B

An hydraulic windmill is described. It pumps pressurized oil from rotor shaft level to the ground where a motor generator produces electricity. Alternatively, the useful output may be heat. Rotor speed is governed by a flow valve. Over pressure, the result of high wind velocity, rotates the tail to move the rotor blades out-of-the-wind. Loss of oil pressure causes a brake to close as well as to swing the tail to its maximum distance from the rotor plane. Author

N82-23701*# Tennessee Univ. Space Inst., Tullahoma.
TWO-DIMENSIONAL TURBULENCE MODELS
Walter Frost and Ming-Chung Lin *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 155-161 refs Sponsored in part by NSF (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Two-dimensional turbulence models are compared with experimental measurements made using an array of instrumented towers. The spatial correlation coefficient, the two-point spectrum or cross spectrum, and the coherence function are discussed. The prediction techniques in general agree reasonably well with the experimental results. Measurements of the integral length scale however, do not correlate well with the prediction model. Author

N82-23702*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
REVIEW OF ANALYSIS METHODS FOR ROTATING SYSTEMS WITH PERIODIC COEFFICIENTS
John Dugundji and John H. Wendell *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 165-172 refs (For primary document see N82-23684 14-44)
(Grant NsG-3303)
Avail: NTIS HC A18/MF A01 CSCL 10B

Two of the more common procedures for analyzing the stability and forced response of equations with periodic coefficients are reviewed: the use of Floquet methods, and the use of multiblade coordinate and harmonic balance methods. The analysis procedures of these periodic coefficient systems are compared with those of the more familiar constant coefficient systems. Author

N82-23703*# Toledo Univ., Ohio. Dept. of Mechanical Engineering.
AN APPROXIMATE METHOD FOR SOLUTION TO VARIABLE MOMENT OF INERTIA PROBLEMS
E. William Beans *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 173-176 (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

An approximation method is presented for reducing a nonlinear differential equation (for the 'weather vaning' motion of a wind turbine) to an equivalent constant moment of inertia problem. The integrated average of the moment of inertia is determined. Cycle time was found to be the equivalent cycle time if the rotating speed is 4 times greater than the system's minimum natural frequency. N.W.

N82-23704*# Institut de Recherche de l'Hydro-Quebec, Varennes.
COMPUTATION OF THE MODES AND POLAR MOMENT OF INERTIAL OF THE BLADES OF AN HAWT
G. Beaulieu and D. Noiseux *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 177-187 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The coupled differential equations of motion of the blades of a horizontal axis wind turbine are solved numerically, permitting the optimization of the design at relatively low cost. The equation of motion is transformed into a set of first order equations and solved with fourth order Runge-Kutta integrators. This technique is applied to a twisted, tapered blade of variable cross section and stiffness including discontinuities. The first six natural frequencies and mode shapes are obtained. The polar moment of inertia of the blades is obtained as a function of frequency and rotational speed. Author

N82-23705*# Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
DYNAMIC ANALYSIS OF DARRIEUS VERTICAL AXIS WIND TURBINE ROTORS
D. W. Lobitz *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 189-197 (For primary document see N82-23684 14-44)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A18/MF A01 CSCL 10B

The dynamic response characteristics of the vertical axis wind turbine (VAWT) rotor are important factors governing the safety and fatigue life of VAWT systems. The principal problems are the determination of critical rotor speeds (resonances) and the assessment of forced vibration response amplitudes. The solution to these problems is complicated by centrifugal and Coriolis effects which can have substantial influence on rotor resonant frequencies and mode shapes. The primary tools now in use for rotor analysis are described and discussed. These tools include a lumped spring mass model (VAWTDYN) and also finite-element based approaches. The accuracy and completeness of current capabilities are also discussed. Author

N82-23706*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
FLUTTER OF DARRIEUS WIND TURBINE BLADES: CORRELATION OF THEORY AND EXPERIMENT
Norman D. Ham *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 199-200 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Flutter analysis of two wind turbines was correlated with experimental data for flutter of Darrieus blades. N.W.

N82-23707*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WHIRL FLUTTER ANALYSIS OF A HORIZONTAL-AXIS WIND TURBINE WITH A TWO-BLADED TEETERING ROTOR
David C. Janetzke and Krishna R. V. Kaza (Toledo Univ.) *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 201-210 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Whirl flutter and the effect of pitch-flap coupling on teetering motion of a wind turbine were investigated. The equations of motion are derived for an idealized five-degree-of-freedom mathematical model of a horizontal-axis wind turbine with a two-bladed teetering rotor. The model accounts for the out-of-plane bending motion of each blade, the teetering motion of the rotor, and both the pitching and yawing motions of the rotor support. Results show that the design is free from whirl flutter. Selected results are presented indicating the effect of variations in rotor support damping, rotor support stiffness, and pitch-flap coupling on pitching, yawing, teetering, and blade bending motions. Author

N82-23708*# Paragon Pacific, Inc., El Segundo, Calif.
WIND ENERGY SYSTEM TIME-DOMAIN (WEST) ANALYZERS
Mark E. Dreier and John A. Hoffman *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 211-219 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A portable analyzer which simulates in real time the complex nonlinear dynamics of horizontal axis wind energy systems was constructed. Math models for an aeroelastic rotor featuring nonlinear aerodynamic and inertial terms were implemented with high speed digital controllers and analog calculation. This model was combined with other math models of elastic supports, control systems, a power train and gimballed rotor kinematics. A stroboscopic display system graphically depicting distributed blade loads, motion, and other aerodynamic functions on a cathode ray tube is included. Limited correlation efforts showed good comparison between the results of this analyzer and other

sophisticated digital simulations. The digital simulation results were successfully correlated with test data. Author

N82-23709*# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
EXPERIENCE ON THE USE OF MOSTAB-HFW COMPUTER CODE FOR HORIZONTAL-AXIS WIND TURBINES
Yi-Yuan Yu *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 221-223 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Three topics are covered dealing with the frequencies of a rotating beam, the use of the fundamental mode of a uniform cantilever beam, and the analysis of resonance dwell. Immensely high peak loads were generated by the code for resonance dwell indicating further need for including structural damping and for transient analysis capability. The effect of structural damping, newly incorporated in the code, is described. T.M.

N82-23710*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF UPWIND AND DOWNWIND ROTOR OPERATION OF THE DOE/NASA 100-kW MOD-0 WIND TURBINE
John C. Glasgow, Dean R. Miller, and Robert D. Corrigan *In its* Wind Turbine Dyn. May 1981 p 225-234 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Tests were conducted on a 38m diameter horizontal axis wind turbine, which had first a rotor downwind of the supporting truss tower and then upwind of the tower. Aside from the placement of the rotor and the direction of rotation of the drive train, the wind turbine was identical for both tests. Three aspects of the test results are compared: rotor blade bending loads, rotor teeter response, and nacelle yaw moments. As a result of the tests, it is shown that while mean flatwise bending moments were unaffected by the placement of the rotor, cyclic flatwise bending tended to increase with wind speed for the downwind rotor while remaining somewhat uniform with wind speed for the upwind rotor, reflecting the effects of increased flow disturbance for downwind rotor. Rotor teeter response was not significantly affected by the rotor location relative to the tower, but appears to reflect reduced teeter stability near rated wind speed for both configurations. Teeter stability appears to return above rated wind speed, however. Nacelle yaw moments are higher for the upwind rotor but do not indicate significant design problems for either configuration. T.M.

N82-23711*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A REVIEW OF RESONANCE RESPONSE IN LARGE HORIZONTAL-AXIS WIND TURBINES
Timothy L. Sullivan *In its* Wind Turbine Dyn. May 1981 p 237-244 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Field operation of the Mod-0 and Mod-1 wind turbines is described. Operational experience shows that 1 per rev excitation exists in the drive train, high aerodynamic damping prevents resonance response of the blade flatwise modes, and teetering the hub substantially reduces the chordwise blade response to odd harmonic excitation. These results can be used by designer as a guide to system frequency placement. In addition it is found that present analytical techniques can accurately predict wind turbine natural frequencies. T.M.

N82-23712*# Rockwell International Corp., Golden, Colo. Energy Systems Group.
SWECS TOWER DYNAMICS ANALYSIS METHODS AND RESULTS
Alan D. Wright, James H. Sexton, Charles P. Butterfield, and Robert M. Thresher (Oregon State Univ., Corvallis) *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 245-253 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Several different tower dynamics analysis methods and computer codes were used to determine the natural frequencies and mode shapes of both guyed and freestanding wind turbine towers. These analysis methods are described and the results for two types of towers, a guyed tower and a freestanding tower, are shown. The advantages and disadvantages in the use of and the accuracy of each method are also described. T.M.

N82-23713*# Sandia Labs., Albuquerque, N. Mex.
GUY CABLE DESIGN AND DAMPING FOR VERTICAL AXIS WIND TURBINES
Thomas G. Carne *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 255-264 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Guy cables are frequently used to support vertical axis wind turbines since guying the turbine reduces some of the structural requirements on the tower. The guys must be designed to provide both the required strength and the required stiffness at the top of the turbine. The axial load which the guys apply to the tower, bearings, and foundations is an undesirable consequence of using guys to support the turbine. Limiting the axial load so that it does not significantly affect the cost of the turbine is an important objective of the cable design. The lateral vibrations of the cables is another feature of the cable design which needs to be considered. These aspects of the cable design are discussed, and a technique for damping cable vibrations was mathematically analyzed and demonstrated with experimental data. T.M.

N82-23714*# Foehn Consulting, Klamath Falls, Oreg.
NORTH WIND 4kW PASSIVE CONTROL SYSTEM DESIGN
Hugh Currin *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 265-270 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

An overview of a mechanical rotor control design is presented. Operation at constant RPM and rapid response are obtained by using blade pitch moments for both sensing control need and blade pitch actuation. The basic concept, static or equilibrium design, and dynamic analysis are briefly presented. Author

N82-23715*# Ventus Energy Corp., La Crescenta, Calif.
PASSIVE CYCLIC PITCH CONTROL FOR HORIZONTAL AXIS WIND TURBINES
Gerald W. Bottrell *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 271-275 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A flexible rotor concept, called the balanced pitch rotor, is described. The system provides passive adjustment of cyclic pitch in response to unbalanced pitching moments across the rotor disk. Various applications are described and performance predictions are made for wind shear and cross wind operating conditions. Comparisons with the teetered hub are made and significant cost savings are predicted. T.M.

N82-23716*# Washington Univ., St. Louis, Mo.
DYNAMICS OF AN EXPERIMENTAL TWO BLADED HORIZONTAL AXIS WIND TURBINE WITH BLADE CYCLIC PITCH VARIATION
Kurt H. Hotenemser and Andrew H. P. Swift *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 277-286 refs Sponsored in part by Midwest Research Inst. (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The turbine under study incorporates the combination of two features: the application of blade cyclic pitch variation; and the use of yaw angle control for rotor speed and torque regulation. Due to its emasculation by passive cyclic pitch variation the rotor can be rapidly yawed without encountering gyroscopic and aerodynamic hub moments and without noticeable out of plane excursions. The two bladed upwind rotor is vane stabilized and of very simple and rugged design. The principle was first checked out with a small scale wind tunnel model and then tested in the atmosphere with a 7.6 meter diameter experimental fully instrumented wind turbine driving a 3 phase alternator. The test results are summarized with respect to structural dynamics and yaw dynamics. T.M.

N82-23717*# Hamilton Standard, Windsor Locks, Conn.
MOD-0 WIND TURBINE DYNAMICS TEST CORRELATIONS

Bennett M. Brooks *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 287-293 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The behavior of the teetered, downwind, free yaw, MOD-0 wind turbine, as represented by NASA dynamic test data, was used to support confidence in the Hamilton Standard computer code simulations. Trim position, performance at trim, and teeter response as predicted by the computer codes were compared to test results. Using the computer codes, other possible configurations for MOD-0 were investigated. Several new test configurations are recommended for exploring free yaw behavior. It is shown that eliminating rotor tilt and optimizing cooling and blade twist can contribute to good free yaw behavior and stability. The effects of rotor teeter, teeter gravity balance, inflow and other physical and operating parameters were also investigated.
Author

N82-23718*# Kaman Aerospace Corp., Bloomfield, Conn.
THE EFFECT OF DELTA 3 ON A YAWING HAWT BLADE AND ON YAW DYNAMICS
Frederick W. Perkins and Robert Jones *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1982 p 295-301 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10A

A single degree of freedom aeroelastic computer model, WMSTAB3, was employed to perform a parametric analysis of HAWT blade behavior during yaw maneuvers. Over 1,000 different combinations of delta sub 3 and normal frequency were analyzed. The effect of delta sub 3 and flapping stiffness on flapping frequency, phase, and magnitude are discussed. The moments transmitted to the fixed system during yaw maneuvers were calculated and reduced to time constants of response to step changes in wind direction. The significance of the time constants for the configurations considered relative to yaw response rate and lag angle is discussed, along with their possible significance for large HAWT.
T.M.

N82-23719*# Sandia Labs., Albuquerque, N. Mex.
VERTICAL AXIS WIND TURBINE DRIVE TRAIN TRANSIENT DYNAMICS
David B. Clauss and Thomas G. Carne *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1982 p 305-314 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Start up of a vertical axis wind turbine causes transient torque oscillations in the drive train with peak torques which may be over two and one half times the rated torque of the turbine. A computer code, based on a lumped parameter model of the drive train, was developed and tested for the low cost 17 meter turbine; the results show excellent agreement with field data. The code was used to predict the effect of a slip clutch on transient torque oscillations. It was demonstrated that a slip clutch located between the motor and brake can reduce peak torques by thirty eight percent.
T.M.

N82-23720*# Power Technologies, Inc., Schenectady, N. Y.
DYNAMICS AND STABILITY OF WIND TURBINE GENERATORS
E. N. Hinrichsen and P. J. Nolan *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 315-324 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Synchronous and induction generators are considered. A comparison is made between wind turbines, steam, and hydro units. The unusual phenomena associated with wind turbines are emphasized. The general control requirements are discussed, as well as various schemes for torsional damping such as speed sensitive stabilizer and blade pitch control. Integration between adjacent wind turbines in a wind farm is also considered.
T.M.

N82-23721*# Kaman Aerospace Corp., Bloomfield, Conn.
KAMAN 40 kW WIND TURBINE GENERATOR - CONTROL SYSTEM DYNAMICS
Richmond Perley *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 325-332 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The generator design incorporates an induction generator for application where a utility line is present and a synchronous generator for standalone applications. A combination of feed forward and feedback control is used to achieve synchronous speed prior to connecting the generator to the load, and to control the power level once the generator is connected. The dynamics of the drive train affect several aspects of the system operation. These were analyzed to arrive at the required shaft stiffness. The rotor parameters that affect the stability of the feedback control loop vary considerably over the wind speed range encountered. Therefore, the controller gain was made a function of wind speed in order to maintain consistent operation over the whole wind speed range. The velocity requirement for the pitch control mechanism is related to the nature of the wind gusts to be encountered, the dynamics of the system, and the acceptable power fluctuations and generator dropout rate. A model was developed that allows the probable dropout rate to be determined from a statistical model of wind gusts and the various system parameters, including the acceptable power fluctuation.
T.M.

N82-23722*# New Mexico Univ., Albuquerque. Engineering Research Inst.
AUTOMATIC CONTROL ALGORITHM EFFECTS ON ENERGY PRODUCTION
Gerald M. McNerney *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 333-342 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A computer model was developed using actual wind time series and turbine performance data to simulate the power produced by the Sandia 17-m VAWT operating in automatic control. The model was used to investigate the influence of starting algorithms on annual energy production. The results indicate that, depending on turbine and local wind characteristics, a bad choice of a control algorithm can significantly reduce overall energy production. The model can be used to select control algorithms and threshold parameters that maximize long term energy production. The results from local site and turbine characteristics were generalized to obtain general guidelines for control algorithm design.
T.M.

N82-23723*# Michigan State Univ., East Lansing.
EFFECT OF WIND TURBINE GENERATOR MODEL AND SITING ON WIND POWER CHANGES OUT OF LARGE WECS ARRAYS
R. A. Schleuter, G. L. Park, M. Lotfalian, J. Dorsey, and H. Shayanfar *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 343-352 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Methods of reducing the WECS generation change through selection of the wind turbine model for each site, selection of an appropriate siting configuration, and wind array controls are discussed. An analysis of wind generation change from an echelon and a farm for passage of a thunderstorm is presented. Reduction of the wind generation change over ten minutes is shown to reduce the increase in spinning reserve, unloadable generation and load following requirements on unit commitment when significant WECS generation is present and the farm penetration constraint is satisfied. Controls on the blade pitch angle of all wind turbines in an array or a battery control are shown to reduce both the wind generation change out of an array and the effective farm penetration in anticipation of a storm so that the farm penetration constraint may be satisfied.
T.M.

N82-23724*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MEASURED AND CALCULATED CHARACTERISTICS OF WIND TURBINE NOISE
George C. Greene *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 355-362 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The results of an analytical and experimental investigation of wind turbine noise are presented. Noise calculations indicate that for configurations with the rotor downwind of the support tower, the primary source of noise is the rapid change in rotor

loadings which occurs as the rotor passes through the tower wake. Noise measurements are presented for solid and truss type tower models with both upwind and downwind rotors. Upwind rotor configurations are shown to be significantly quieter than downwind configurations. The model data suggest that averaged noise measurements and noise calculations based on averaged tower wake characteristics may not accurately represent the impulsive noise characteristics of downwind rotor configurations. Author

N82-23725*# Wichita State Univ., Kans. Wind Energy Lab.
DYNAMICS OF WAKES DOWNSTREAM OF WIND TURBINE TOWERS
Melvin H. Snyder and W. H. Wentz, Jr. *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 369-373 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The near field wakes downstream of circular cylinders and of 12 sided cylinders were surveyed in a wind tunnel. Local velocity and velocity deficit diagrams are presented. The variation of turbulence in the wake was surveyed and the frequency of the periodic component of wake motion was determined. Differences between wakes of circular cylinders and of 12 sided cylinders are discussed. Also effects of strakes, orientation of the 12 sided cylinders, and rounding of the corners are noted. Author

N82-23726*# Midwest Research Inst., Golden, Colo. Wind Energy Branch.
ACOUSTIC NOISE GENERATION BY THE DOE/NASA MOD-1 WIND TURBINE
Neil D. Kelley *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 375-387 refs Sponsored in part by DOE (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The results of a series of measurements taken over the past year of the acoustic emissions from the DOE/NASA MOD-1 Wind Turbine show the maximum acoustic energy is concentrated in the low frequency range, often below 100 Hz. The temporal as well as the frequency characteristics of the turbine sounds have been shown to be important since the MOD-1 is capable of radiating both coherent and incoherent noise. The coherent sounds are usually impulsive and are manifested in an averaged frequency domain plot as large numbers of discrete energy bands extending from the blade passage frequency to beyond 50 Hz on occasion. It is these impulsive sounds which are identified as the principal source of the annoyance to a dozen families living within 3 km of the turbine. The source of the coherent noise appears to be the rapid, unsteady blade loads encountered as the blade passes through the wake of the tower structure. Annoying levels are occasionally reached at nearby homes due to the interaction of the low frequency, high energy peaks in the acoustic impulses and the structural modes of the homes as well as by direct radiation outdoors. The peak levels of these impulses can be enhanced or subdued through complete propagation. Author

N82-23727*# General Electric Co., Schenectady, N. Y.
GE MOD-1 NOISE STUDY
R. J. Wells *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 389-395 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Noise studies of the MOD-1 Wind Turbine Generator are summarized, and a simple mathematical noise is presented which is adequate to correlate the sound levels found near the machine. A simple acoustic measure is suggested for use in evaluating far field sound levels. Use of this measure as input to a currently available sound complaint prediction program is discussed. Results of a recent statistical survey relative to the far field variation of this acoustic measure because of atmospheric effects are described. Author

N82-23728*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
ENHANCEMENT OF FAR FIELD SOUND LEVELS BY REFRACTIVE FOCUSING
Dennis W. Thomson and S. David Roth *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 397-400 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

The enhancement of sound pressure levels resulting from refractive focusing was calculated for meteorological conditions representative of those observed at the MOD-1 site near Boone, N.C. The results show that 10 to 20dB enhancements can occur over ranges of several hundred meters. Localized enhancements in excess of 20dB can occur but will probably be of limited duration as a consequence of normal temporally varying meteorological conditions. Author

N82-23729*# Massachusetts Inst. of Tech., Cambridge.
PREDICTION OF LOW FREQUENCY AND IMPULSIVE SOUND RADIATION FROM HORIZONTAL AXIS WIND TURBINES
Rudolph Martinez, Sheila E. Widnall, and Wesley L. Harris *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 401-409 refs Sponsored in part by Midwest Research Inst. (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Theoretical models to predict the radiation of low frequency and impulsive sound from horizontal axis wind turbines due to three sources: (1) steady blade loads; (2) unsteady blade loads due to operation in a ground shear; (3) unsteady loads felt by the blades as they cross the tower wake. These models are then used to predict the acoustic output of MOD-1, the large wind turbine operated near Boone, N.C. Predicted acoustic time signals are compared to those actually measured near MOD-1 and good agreement is obtained. Author

N82-23730*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA-LeRC WIND TURBINE SOUND PREDICTION CODE
Larry A. Viterna *In its* Wind Turbine Dyn. May 1981 p 411-418 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Since regular operation of the DOE/NASA MOD-1 wind turbine began in October 1979 about 10 nearby households have complained of noise from the machine. Development of the NASA-LeRC with turbine sound prediction code began in May 1980 as part of an effort to understand and reduce the noise generated by MOD-1. Tone sound levels predicted with this code are in generally good agreement with measured data taken in the vicinity MOD-1 wind turbine (less than 2 rotor diameters). Comparison in the far field indicates that propagation effects due to terrain and atmospheric conditions may be amplifying the actual sound levels by about 6 dB. Parametric analysis using the code has shown that the predominant contributions to MOD-1 rotor noise are: (1) the velocity deficit in the wake of the support tower; (2) the high rotor speed; and (3) off column operation. Author

N82-23731*# Boeing Vertol Co., Philadelphia, Pa.
NOISE GENERATION OF UPWIND MOTOR WIND TURBINE GENERATORS
R. H. Spencer *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 419-423 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

Noise sources of wind turbines with rotors upstream of the support structure are discussed along with methodology for sound level prediction. Estimated noise levels for the MOD-2 wind turbine are presented operating in both the upwind and downwind configurations. Results indicate that upwind rotor configurations may be advantageous from an acoustical standpoint. Author

N82-23732*# Hamilton Standard, Windsor Locks, Conn.
DOWNWIND ROTOR HORIZONTAL AXIS WIND TURBINE NOISE PREDICTION
F. B. Metzger and R. J. Klatte *In* NASA. Lewis Research Center Wind Turbine Dyn. May 1981 p 425-430 refs Sponsored in part by NASA. Langley Research Center, Midwest Research Inst., and Wichita State Univ. (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

NASA and industry are currently cooperating in the conduct

of extensive experimental and analytical studies to understand and predict the noise of large, horizontal axis wind turbines. This effort consists of (1) obtaining high quality noise data under well controlled and documented test conditions, (2) establishing the annoyance criteria for impulse noise of the type generated by horizontal axis wind turbines with rotors downwind of the support tower, (3) defining the wake characteristics downwind of the axial location of the plane of rotation, (4) comparing predictions with measurements made by use of wake data, and (5) comparing predictions with annoyance criteria. The status of work by Hamilton Standard in the above areas which was done in support of the cooperative NASA and industry studies is briefly summarized. Author

N82-23733*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
WIND TURBINE ACOUSTIC STANDARDS
David G. Stephens, Kevin P. Shepherd (Bionetics Corp., Hampton, Va.), and Ferdinand Grosveld (Bionetics Corp., Hampton, Va.) *In* NASA Lewis Research Center Wind Turbine Dyn. May 1981 p 431-435 refs (For primary document see N82-23684 14-44)
Avail: NTIS HC A18/MF A01 CSCL 10B

A program is being conducted to develop noise standards for wind turbines which minimize annoyance and which can be used to design specifications. The approach consists of presenting wind turbine noise stimuli to test subjects in a laboratory listening chamber. The responses of the subjects are recorded for a range of stimuli which encompass the designs, operating conditions, and ambient noise levels of current and future installations. Results to date have established the threshold of detectability for a range of impulsive stimuli of the type associated with blade/tower wake interactions. The status of the ongoing psychoacoustic tests, the subjective data, and the approach to the development of acoustic criteria/standards are described. Author

N82-23734# Department of Energy, Washington, D. C. Office of Facility Planning and Support.
[ENERGY CONSERVATION IN BUILDINGS AND GENERAL OPERATIONS] Annual Report
Jan. 1981 26 p
(DE82-002723; DOE/MA-0004) Avail: NTIS HC A03/MF A01

An In-house Energy Management program designed to reduce energy consumption and increase energy efficiency in buildings and general operations facilities, is described. The major goals of the program are: retrofit of all buildings to improve energy efficiency and assure minimum life cycle costs by 1990; reduction, in existing DOE buildings by 20% and in new DOE buildings by 45%, of average energy use per gross square foot by FY 1985, as compared to FY 1975 usage; reduction of petroleum-based fuels use by 30% by FY 1985, as compared to FY 1975 usage; and discontinuation of petroleum in major fuel burning installations by FY 2000; discontinuation of the use of natural gas in MFBI by FY 2000; and implementation of cost effective solar and other renewable energy systems. DOE's active program in energy conservation surveys and studies, retrofit and maintenance improvements, procurement of fuel efficient vehicles, driver training, and employee awareness enabled the Department to reduce its energy consumption in FY 1980 by approximately 14%, as compared to the embargo year of 1973. DOE

N82-23735# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 1: EXECUTIVE SUMMARY Final Report
T. W. McCafferty, W. C. Walke, and J. S. Bonk 31 Jul. 1981 133 p Prepared in cooperation with Sargent and Lundy, Engineers and Westinghouse Electric Corp., Concordville, Pa. 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000270; DOE/ET-29232/T4-Vol-1) Avail: NTIS HC A07/MF A01

The behavior and suitability of an aquifer-based compressed air energy storage (CAES) facility were investigated. The project was part of a five-phase program to promote compressed air energy storage and underground pumped hydro in the United States. The background, project organization, and summarization of all project work are provided. T.M.

N82-23736# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 3A: SITE SELECTION STUDY, PART 1 Final Report
W. C. Walke 31 Jul. 1981 121 p refs Prepared in cooperation ith Sargent and Lundy, Engineers 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000675; DOE/ET-29232/T4-Vol-3A) Avail: NTIS HC A06/MF A01

A preferred ranking for aquifer sites potentially capable of supporting a CAES facility is provided. The study area that was investigated for possible aquifer storage sites comprises roughly the Illinois and Indiana portions of the geologic structure known as the Illinois Basin. Sites in Illinois and Indiana adjacent to the Illinois Basin that appeared suitable geologically were also investigated. Potential sites in this area were identified by the Illinois State Geological Survey (ISGS) and the Indiana Geological Survey (IGS). T.M.

N82-23737# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AQUIFER. VOLUME 6: BALANCE OF PLANT DESIGN Final Report
31 Jul. 1981 534 p refs Prepared in cooperation with Sargent and Lundy, Engineers 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000670; DOE/ET-29232/T4-Vol-6) Avail: NTIS HC A23/MF A01

The behavior and suitability of an aquifer-based compressed-air energy storage (CAES) plant was studied. Methodologies and preliminary design procedures for developing, designing, constructing, and operating a CAES facility utilizing an aquifer storage formation were established earlier. The balance of plant design considerations for a CAES plant are given. The design of the above ground facilities including well locations, fuel oil storage, switchyard, facility access, plant and equipment arrangement, and process flow diagrams are discussed. DOE

N82-23738# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 7: ENVIRONMENTAL, SAFETY, AND LICENSING CONSIDERATIONS Final Report
31 Jul. 1981 364 p refs Prepared in cooperation with Sargent and Lundy, Engineers 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000669; DOE/ET-29232/T4-Vol-7) Avail: NTIS HC A16/MF A01

The behavior and suitability of aquifers as compressed-air energy storage (CAFS) sites was studied. The probability, severity, and recommended control measures for the environmental and safety impacts that could result from the construction and operation of a CAES facility are described. The permits and approvals that would be required and the time estimated for their acquisition are also described. DOE

N82-23739# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 8: AQUIFER FLOW CODE SIMULATION Final Report
D. L. Ayers 31 Jul. 1981 301 p refs Prepared in cooperation with Westinghouse Electric Corp., West Lafayette, Ind. 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000668; DOE/ET-29232/T4-Vol-8) Avail: NTIS Hc A10/MF A01

The behavior and suitability of an aquifer-based compressed air energy storage (CAES) plant were investigated. Methodologies and preliminary design procedures for developing, designing,

constructing, and operating a CAES facility utilizing an aquifer storage formation were established. Descriptions, development, and results from a one-dimensional air flow computer model, two-dimensional air flow computer model, and a manifold air flow/pressure loss model are provided. These models are analytic tools used to predict aquifer performance and CAES system analysis. DOE

N82-23740# Public Service Co. of Indiana, Plainfield.
COMPRESSED-AIR ENERGY STORAGE: PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 9: COST ESTIMATE AND SCHEDULE Final Report
31 Jul. 1981 115 p ref Prepared in cooperation with Sargent and Lundy, Engineers 9 Vol.
(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. RP-1081-3)
(DE82-000667; DOE/ET-29232/T4-Vol-9) Avail: NTIS HC A06/MF A01

The engineering and construction schedule, facilities capital cost estimate and corresponding cash flow requirements relative to the construction of a compressed-air energy storage facility on an aquifer site is discussed. DOE

N82-23741# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR COGENERATION FACILITY: CIMARRON RIVER STATION, CENTRAL TELEPHONE AND UTILITIES-WESTERN POWER. EXECUTIVE SUMMARY
7 Aug. 1981 38 p 3 Vol.
(Contract DE-AC03-81SF-11439)
(DE82-001898; DOE/SF-11439/1-Vol-1) Avail: NTIS HC A03/MF A01

A brief overview of the conceptual design of a solar central receiver system integrated with an existing cogeneration facility is provided. A synopsis of the performance, an economic evaluation, and an assessment of the concept from the site owner's perspective are given. DOE

N82-23742# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR COGENERATION FACILITY: CIMARRON RIVER STATION, CENTRAL TELEPHONE AND UTILITIES-WESTERN POWER Final Report
7 Aug. 1981 24 p refs 3 Vol.
(Contract DE-AC03-81SF-11439)
(DE82-001921; DOE/SF-11439/1-Vol-2) Avail: NTIS HC A02/MF A01

A site-specific conceptual design and evaluation of a solar central receiver system integrated with an existing cogeneration facility are described. The system generates electricity and delivers a portion of that electricity and process steam to a natural gas processing plant. Early in the project, tradeoff studies were performed to establish key system characteristics. As a result of these studies the use of energy storage was eliminated, the size of the solar facility was established at 37.13 MW (sub t), and other site-specific features were selected. The conceptual design addressed critical components and system interfaces. The result is a hybrid solar/fossil central receiver facility which utilizes a collector system of Department of Energy second generation heliostats. DOE

N82-23743# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR COGENERATION FACILITY: CIMARRON RIVER STATION, CENTRAL TELEPHONE AND UTILITIES-WESTERN POWER, APPENDICES
7 Aug. 1981 24 p refs
(Contract DE-AC03-81SF-11439)
(DE82-001852; DOE/SF-11439/1-Vol-3) Avail: NTIS HC A10/MF A01

The characteristics, design requirements, and environmental requirements for the solar cogeneration facility are specified, including conceptual design, performance, and economic data for the solar facility and certain design data for the existing facility. A detailed breakdown of the construction cost estimate is provided. DOE

N82-23744# United Technologies Research Center, East Hartford, Conn.
UTRC 8-kW WIND SYSTEM. PHASE 2: FABRICATION AND TEST
R. B. Taylor and M. C. Cheney 4 Feb. 1981 96 p refs
(Contract DE-AC04-76DP-03533)
(DE82-003885; RFP-3232/2) Avail: NTIS HC A05/MF A01

Full scale hardware fabrication of the 8 kW wind turbine, and the results of the preliminary testing conducted at East Hartford, CT are described. Findings from a wind tunnel test of a 1/3 scale model, which was conducted to evaluate the rotor stability characteristics under stalled overspeed conditions, are summarized. Although two low speed start-up problems were encountered during the full-scale testing, and subsequently corrected, the system demonstrated the predicted performance characteristics and the basic operating features which are unique to the UTRC design. DOE

N82-23745# JRB Associates, McLean, Va.
DESIGN HANDBOOK FOR PHOTOVOLTAIC-POWER SYSTEMS: SIMPLIFIED METHODS FOR UTILITY INTERCONNECTED SYSTEMS
Y. P. Gupta and S. K. Young Oct. 1981 233 p refs
(Contract DE-AC04-76DP-00789)
(DE82-003909; SAND-80-7147-Vol-2) Avail: NTIS HC A11/MF A01

Two nomograms are presented, one for computing the economic feasibility of a photovoltaic system, and the other for sizing the preliminary PB array area. Worksheets are provided for computing PV system economic feasibility, preliminary collector area estimates, electerical loads, system output and costs, present worth analysis, solar fraction, array sizing analysis, and thermal analysis for combined PV/thermal systems. Climate statistics and insolation, shading factors, daytime solar fraction coefficients and present worth factors are tabulated. DOE

N82-23746# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE REPORT. VOLUME 4: FOR NEWMAN POWER STATION, EL PASO, TEXAS
Oct. 1981 16 p refs Prepared in cooperation with Boeing Computer Services Co., Seattle
(Contract DE-AC04-76DP-00789)
(DE82-002681; SAND-81-7086/4) Avail: NTIS HC A02/MF A01

Performance data are given for a photovoltaic power supply at a Texas utility for the month of August 1981. Included are: total and daily electrical energy production; total monthly and daily incident solar energy; monthly and daily efficiency; graphs of energy production as a function of power level, voltage, cell temperature, and hour of the day; system availability; heating and cooling degree days, average monthly insolation, ambient temperature and wind speed, and average insolation, ambient temperature, cell temperature, and wind speed graphed versus hour of the day. DOE

N82-23747# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL EXECUTIVE SUMMARY. VOLUME 3: FOR LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NEW MEXICO
Oct. 1981 7 p refs
(Contract DE-AC04-76DP-00789)
(DE82-003082; SAND-81-7099/3) Avail: NTIS HC A02/MF A01

For the month of August 1981, daily and monthly electricity production and daily, monthly insolation and monthly array efficiency are given. These data are given for a 100 kW photovoltaic flat panel facility at a New Mexico shopping center. DOE

N82-23748# United Technologies Research Center, East Hartford, Conn.
UTRC 8-kW WIND SYSTEM. PHASE 2: FABRICATION AND TEST, EXECUTIVE SUMMARY
R. B. Taylor and M. C. Cheney 4 Feb. 1981 13 p refs
(Contract DE-AC04-76DP-03533)

(DE82-003883; RFP-3232/1) Avail: NTIS HC A02/MF A01

A final design that was evolved is a horizontal axis, two-bladed, down-wind free-yaw rotor with a diameter of 9.45 m (31 ft) and a steel tower with 16.8-m (55-ft) height that is supported by guy wires. Field testing of the prototype was completed and successfully demonstrated the various features of the UTRC 8 kW wind turbine. Test evaluation is presently continuing at Rocky Flats, CO, and preliminary results indicate that the WTG is performing well in all aspects. The various features of the UTRC Bearingless Wind Turbine, which were conceived and wind tunnel tested during the earlier ERDA contracts and the first year of this program, were successfully demonstrated in full-scale during the field testing reported. The specific operating characteristics which were verified are: the passive self-starting feature, the proper blade pitch schedule to place the blade at its pitch setting for high performance, the automatic pitch increase to place the blade at its stall angle to limit rotor speed in the event of decoupling from the grid, and the passive yaw feature which provides for the continuous self-alignment to wind direction changes. DOE

N82-23749# JBF Scientific Corp., Wilmington, Mass.

SMALL-WIND-SYSTEMS APPLICATION ANALYSIS. TECHNICAL REPORT AND EXECUTIVE SUMMARY

Jun. 1981 384 p refs Sponsored in part by Rockwell International Corp., Golden, Colo.

(Contract DE-AC04-76DP-03533)

(DE82-003748; RFP-3147/2) Avail: NTIS HC A17/MF A01

A small wind energy conversion systems (SWECS) analysis was conducted to estimate the potential market for SWEC, or wind machines smaller than 100 kW for five selected applications. The goals were to aid manufacturers in attaining financing by convincing venture capital investors of the potential of SWECS and to aid government planners in allocating R and D expenditures that will effectively advance SWECS commercialization. Based on these goals, the study: (1) provides a basis for assisting the DOE in planning R and D programs that will advance the state of SWECS industry; (2) quantifies estimates of market size vs. installed system cost to enable industry to plan expansion of capacity and product lines; (3) identifies marketing strategies for industry to use in attaining financing from investors and in achieving sales goals; and (4) provides DOE with data that will assist in determining actions, incentives, and/or legislation required to achieve a commercially viable SWECS industry. The five applications were selected through an initial screening and priority-ranking analysis. The year of analysis was 1985, but all dollar amounts, such as fuel costs, are expressed in 1980 dollars. The five SWECS applications investigated were farm residences, non-farm residences, rural electric cooperatives, feed grinders, and remote communities. DOE

N82-23750# Martin Marietta Corp., Denver, Colo. Aerospace Dept.

THERMAL STORAGE FOR SOLAR COOLING USING PAIRED AMMONIATED SALT REACTORS Final Report

Sep. 1981 300 p refs

(Contracts DE-AC02-78CS-34700; EM-78-C-02-4700)

(DE82-002080; DOE/CS-34700/T1) Avail: NTIS HC A13/MF A01

The feasibility of using various solid and liquid ammoniates in heat pump-thermal storage systems for space heating and cooling was conducted. Corrosion testing of selected metallic and non-metallic specimens in the ammoniates was investigated. Results of the corrosion testing showed that problems exist with manganese and magnesium chloride ammoniates, except with the teflon which displayed excellent resistance in all environments. Also, all liquid ammoniates are unsuitable for use with uncoated carbon steel. Cycling of the manganese chloride between the high and low ammoniates does not affect its properties. However, the density change between the high and low ammoniates could cause packing problems in a reactor which constrains the salt volume. Subscale tests with solid ammoniates indicated that the heat transfer coefficient in a fixed bed reactor is low (approx. 1 Btu/h-ft(2)-OF). Therefore solid ammoniates are not practical because of the high heat exchanger cost requirement. DOE

N82-23751# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

LOW COST SOLAR ENERGY COLLECTION FOR COOLING APPLICATIONS

W. G. Wilhelm Jun. 1981 19 p refs

(Contract DE-AC02-76CH-00016)

(DE82-003255; BNL-51408) Avail: NTIS HC A02/MF A01

Solar energy collector designs utilizing thin-film polymeric materials in the absorber and glazing are investigated. The main objective is dramatic cost reduction consistent with acceptable performance and life. These collectors now appear capable of high temperature applications including desiccant and absorption cooling (1500 to 2000 F). The performance and economics of the thin-film collector are compared with those of conventional flat-plate designs in cooling applications. DOE

N82-23752# Sandia Labs., Albuquerque, N. Mex.

ANALYSIS OF 70-TUBE PILOT-PLANT SOLAR-RECEIVER-PANEL TEST DATA

Lubomyra N. Kmetyk and Rupert K. Byers Aug. 1981 65 p refs

(Contract DE-AC04-76DP-00789)

(DE82-001728; SAND-81-1220) Avail: NTIS HC A04/MF A01

An analytic model for a solar receiver boiler panel was developed, using the RELAP4 nuclear plant systems thermal hydraulic computer code. Results are compared to other computer calculations and experimental data. The test panels were prototypes of panels to be used in the Barstow 10 MWe solar electric pilot power plant central receiver. Steady state operating conditions for a given incident heat flux were calculated from a zero power cold water startup. The effects of incident flux axial profile shape and of lateral flux gradients were studied, as was the dynamic response of the model to flux and flow transients. The nodalization detail required for accurate simulation was also determined. DOE

N82-23753# Acres American, Inc., Buffalo, N.Y.

PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 8: DESIGN APPROACHES. UPH, APPENDIX D: POWER PLANT Final Report

Jun. 1981 607 p Sponsored in part by Electric Power Research Inst. Prepared for Potomac Electric Power Co., Washington, D.C.

(Contract DE-AC02-77ET-28013; EPRI Proj. 1081-1)

(DE82-003075; EPRI-EM-1589-Vol-8-App-D; DOE/ET-5047/8.D) Avail: NTIS HC A99/MF A01

Studies were undertaken to determine power plant arrangements for a single stage reversible pump turbine two step underground pumped hydro (UPH) installation and for a multi-stage reversible pump turbine single step (MSRPT) UPH installation. Arrangements consist of: the underground powerhouses; transformer galleries; associated mechanical and electrical equipment; the administration and control building; hoist head frames; the access; draft tube and bus tunnels; and the switchyard. Primary considerations including the number and size of pump turbine and motor generator units, starting methods, transformers, high voltage connections, geotechnical and construction aspects and safety were studied. A feasibility analysis to minimize costs was conducted. The study led to the selection of suitable equipment and layouts for the powerhouses, transformer galleries, and associated facilities. The material presented and also the cost estimates are based on the requirements for a 2000 MW plant providing 20,000 MWh of storage with a nominal head of 4600 ft. DOE

N82-23754# Department of Energy, Washington, D. C. Energy Information Administration.

SHORT-TERM ENERGY OUTLOOK: METHODOLOGY

Colleen Cornett, Debra Paxson, Arnold P. Reznek, Cecelia Chu, Scott Sitzer, Neil Gamson, J. Philip Childress, Stanley Paul, Henry Weigel, Scott Sutton et al May 1981 128 p 2 Vol.

(DE82-002940; DOE/EIA-0202/7-2) Avail: NTIS HC A07/MF A01

Detailed discussions of forecasting methodology and analytical topics concerning short-term energy markets are presented. Major assumptions necessary to make the energy forecasts are also discussed. Supplementary analyses of topics related to short-term

energy forecasting are also given. The discussions relate to the forecasts prepared using the short term integrated forecasting system. This set of computer models uses data from various sources to develop energy supply and demand balances. Econmetric models used to predict the demand for petroleum products, natural gas, coal, and electricity are discussed. Price prediction models are also discussed. The role of oil inventories in world oil markets is reviewed. Various relationship between weather patterns and energy consumption are discussed. DOE

N82-23755# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE: EXECUTIVE SUMMARY. VOLUME 1: LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NEW MEXICO
Sep. 1981 16 p refs Prepared in cooperation with Boeing Computer Services Co., Seattle
(Contract DE-AC04-76DP-00789)
(DE82-001710; SAND-81-7099/1) Avail: NTIS HC A02/MF A01

For the months of April through June 1981, performance data are given for a 100 kW photovoltaic flat panel grid connected facility at a New Mexico shopping center. For each month, the monthly total electrical energy production and insolation, and array efficiency are given and the daily energy produced and insolation are graphed. DOE

N82-23756# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE: EXECUTIVE SUMMARY. VOLUME 2: NEWMAN POWER STATION, EL PASO, TEXAS
Sep. 1981 23 p Prepared in cooperation with Boeing Computer Services Co., Seattle
(Contract DE-AC04-76DP-00789)
(DE82-001711; SAND-81-7100/2) Avail: NTIS HC A02/MF A01

For the months of February through July 1981, except June, performance data are given for a 20 kWg photovoltaic flat panel power system for an uninterruptable power supply load in Texas. For each month, the monthly total electrical energy production and insolation and array efficiency are given and the daily energy production and insolation are graphed. DOE

N82-23757# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE: EXECUTIVE SUMMARY. VOLUME FOR BEVERLY HIGH SCHOOL, BEVERLY, MASSACHUSETTS
Sep. 1981 10 p refs Prepared in cooperation with Boeing Computer Services Co., Seattle
(Contract DE-AC04-76DP-00789)
(DE82-001726; SAND-81-7102/1) Avail: NTIS HC A02/MF A01

For the month of July 1981, performance data are given for a grid connected 100 kW photovoltaic flat panel power system at a high school in Massachusetts. The total electrical energy produced and solar energy incident on the solar cells, array and system efficiency, capacity factor, and insolation are given for the month and the daily energy production and incident solar energy are graphed. DOE

N82-23758# Sandia Labs., Albuquerque, N. Mex.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL PERFORMANCE: EXECUTIVE SUMMARY. VOLUME 1 FOR MT. LAGUNA RADAR STATION, MT. LAGUNA, CALIFORNIA
Sep. 1981 28 p refs Prepared in cooperation with Boeing Computer Services Co., Seattle
(Contract DE-AC04-76DP-00789)
(DE82-001727; SAND-81-7104/1) Avail: NTIS HC A03/MF A01

For the months of January through July 1981, performance data are given for a photovoltaic array with two different types of photovoltaic modules, a paralleling, and monitoring panel, a power conversion subsystem, and a data acquisition system. For each month, the monthly total electrical energy production and insolation, array efficiency, system efficiency, and capacity factor are given and the daily energy production and insolation are graphed. DOE

N82-23759# Board of Chosen Freeholders, Woodbury, N.J.
FEASIBILITY STUDY: CODISPOSAL WITH ENERGY RECOVERY FROM WASTEWATER SLUDGE AND MUNICIPAL REFUSE. PHASE 2, GLOUCESTER COUNTY, NEW JERSEY
Jul. 1981 157 p refs
(Contract DE-AC01-79CS-20212)
(DE82-000882; DOE/CS-20212/1) Avail: NTIS HC A08/MF A01

The feasibility of thermal reduction of dewatered sludge and mixed municipal refuse with steam recovery for generation of electricity is investigated. The Gloucester County Utilities Authority wastewater treatment complex would produce the sludge and benefit from the generated electricity from a waste to energy system located on adjacent property. DOE

N82-23760# Southern Methodist Univ., Dallas, Tex.
THIN-FILM CADMIUM TELLURIDE AND ZINC PHOSPHIDE SOLAR CELLS Final Report, Mar. - May 1981
T. L. Chu Jun. 1981 27 p refs
(Contract DE-AC02-79ET-23009)
(DE82-001941; DOE/ET-23009/T12) Avail: NTIS HC A03/MF A01

Major efforts during this quarter were directed to the deposition and characterization of zinc phosphide and cadmium telluride films and solar cells. The deposition of zinc phosphide films by the reaction of zinc and phosphine in a hydrogen atmosphere was continued and the composition of deposited films was determined. For more efficient utilization of phosphine, a 8500 C zone was added to the deposition. The in-situ annealing of zinc phosphide in phosphine was carried out. Attempts to prepare solar cell structures by depositing a thin film of zinc phosphide on an annealed film were made; however, the results are inconclusive. The deposition of cadmium telluride films by the direct combination of the elements under reduced pressure and under atmospheric pressure was carried out. Films deposited under reduced pressure exhibited more compact grain structures, however, they showed poor photoresponse. The composition of the films deposited under atmospheric pressure were analyzed and the dependence of short circuit density on the reactant composition was investigated. DOE

N82-23761# General Electric Co., Washington, D. C.
ENERGY USE IN OFFICE BUILDINGS: ANALYSIS OF USE IN A RANDOM SAMPLE OF 1100 BUILDINGS
Jun. 1981 106 p refs
(Contract DE-AC01-79CS-20189)
(DE82-000518; DOE/CS-20189/3) Avail: NTIS HC A06/MF A01

The collection and analysis of an energy use data base obtained from a sample of approximately 1100 randomly selected major office buildings located in 20 US cities are reported. Information on the collection of the data and on the characteristics of the buildings for which data were gathered is given. A tabular analysis of the energy consumption data is performed by census division, fuel type, building age, height, downtown/suburban location, and class of space. The data base (denoted as the 20-city data base) is compared to the data base obtained from the experience exchange report denoted as the EER office building sample. Both data bases were for the year 1977. Tables present the comparison of the two data bases. In general the EER office building sample buildings used more energy than did the buildings in the 20-city data base: i.e., the buildings in the experience exchange report are biased towards higher energy use buildings. Furthermore, the EER office building sample has proportionally more gas and steam buildings than does the random sample. On a national basis the EER office building sample buildings used approximately 10% more energy than did the buildings in the 20-city data base in 1977. DOE

N82-23762# Department of Energy, Washington, D. C.
ENERGY-EFFICIENT WINDOWS
Sep. 1981 8 p refs
(DE82-000940; DOE/CE-0021) Avail: NTIS HC A02/MF A01

Specific issues concerning potential flaws in window systems in the built environment are discussed. Industry organizations are listed as well as available publications, and reports on energy efficient window systems. DOE

N82-23763# New England Congressional Inst., Washington, D.C.
ENERGY IN NEW ENGLAND: TRANSITION TO THE 80'S
R. Katz, Lock Pawlick, and Bailey Spencer 22 Jun. 1981 74 p refs
(DE82-000234; DOE/TIC-2000234) Avail: NTIS HC A04/MF A01

Activities in New England which result in more efficient consumption of energy are discussed. Change in aggregrate energy demand since the oil embargo, energy use and the regional economy, incentives for conservation, and decline in electricity growth are also discussed. The conributions made by wood products, hydroelectric power, solid waste, solar, wind, alcohol fuels, peat, and tidal power are disclosed. Changes in consumption of individual conventional energy products (petroleum, natural gas, nuclear power, coal, purchased electricity) and activity currently underway in the conventional fuel area are summarized. DOE

N82-23764# Massachusetts Inst. of Tech., Cambridge.
PHOTOCHEMICAL ENERGY STORAGE: STUDIES OF INORGANIC PHOTOASSISTANCE AGENTS Progress Report, 17 Dec. 1980 - 14 Sep. 1981
Mark S. Wrighton Sep. 1981 31 p refs
(Contract DE-AS02-76ER-04178)
(DE82-000403; DOE/ER-04178/5) Avail: NTIS HC A03/MF A01

Work concerning the use of certain n- and p-type semiconductors, including Si, InP, WS2, TiO2, and SrTiO3, as photoelectrode materials in photoelectrohemical cells for optical energy conversion is reported. Additionally, intrinsic a-Si:H on a stainless steel substrate was characterized where the contact to the stainless steel is a thin, heavily doped n-type layer resulting in an ohmic contact near the conduction band. Study of p-type Si bearing a redox polymer/Pt(0) or Pd(0) catalyst system was ongoing and improvements in photoelectrochemical H2 generation via surface catalysis were demonstrated. Highlights of the accomplishments so far are: (1) the demonstration that n-type WS2-based photoelectrochemical cells can be used to sustain the uphill converson of SO2 and H2O to H2SO4 and H2 in 50% by weight H2SO4; (2) establishment of the behavior of photoconductor (a-Si:H) electrodes in contact with liquid electrolytes. DOE

N82-23765# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Solar Energy Systems Dept.
FORT HOOD SOLAR COGENERATION FACILITY CONCEPTUAL DESIGN STUDY. VOLUME 1: TECHNICAL REPORT Final Technical Report
Aug. 1981 397 p 2 Vol.
(Contract DE-AC03-81SF-11495)
(DE82-000836; DOE/SF-11495/T1-Vol-1; MDC-G-9716-Vol-1)
Avail: NTIS HC A17/MF A01

A solar heated heat transfer salt provides heat to a steam generation and provides space heating and air conditioning and hot water for the complex. The site and its climate are described briefly. Candidate site specific system configurations, technology assessments, system sizing, and the results of numerous trade studies leading toward the selection of the preferred system configuration are presented. A system level conceptual design of the cogeneration facility is presented, and the cconceptual design of the subsystems (heliostats, receiver, tower, energy transport and storage, fossil energy subsystem, electric power generation subsystem, control, space conditioning and domestic hot water subsystem) are described. Results of the economic analysis of the cogeneration facility are presented, including a description of analysis methods used, assumptions and rationale, simulation models used, a brief summary of capital and operations and maintenance costs, fuel savings, results of the economic evaluations and an economic scenario for future applications. T.M.

N82-23766# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Solar Energy Program Dept.
FORT HOOD SOLAR COGENERATION FACILITY CONCEPTUAL DESIGN STUDY. VOLUME 2: SYSTEM SPECIFICATION Final Technical Report
Aug. 1981 324 p refs 2 Vol.
(Contract DE-AC03-81SF-11495)
(DE82-001579; DOE/SF-11495/T1-Vol-2; MDC-G-9716-Vol-2)
Avail: NTIS HC A14/MF A01

The characteristics and design and the environmental requirements for a solar cogeneration facility at a Texas military facility are specified. In addition, the conceptual design and performance characteristics, cost and economic data and other information for the cogeneration facility designed to meet the requirements are summarized. DOE

N82-23767# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
TEXASGULF SOLAR COGENERATION PROGRAM, VOLUME 1 Final Report, 1 Sep. 1980 - 1 Jun. 1981
D. J. Bisantz, K. D. Bishop (Texasgulf Chemicals Co.), W. Herrington (Texasgulf Chemicals Co.), H. E. Jones, P. Karnoski (Brown and Root Development, Inc.), and S. I. Schwartz Jun. 1981 158 p 2 Vol.
(Contract DE-AC03-80SF-11437)
(DE82-001900; DOE/SF-11437/T4-Vol-1) Avail: NTIS HC A05/MF A01

A site specific conceptual design was generated for a near term Solar Cogeneration Facility based upon solar central receiver technology. Various system trade studies were conducted to select an optimum system configuration for the selected industrial site, as well as a configuration with the potential for wide industrial applicability. System performance and cost estimates were prepared and utilized to assess the economics of the near term facility, as well as a similar commercial size facility. A development plan was then generated with the objective of efficiency achieving facility operation by 1985. The selected industrial site is Texasgulf's Comanche Creek Sulfur Mine near Fort Stockton, Texas. The Solar Cogeneration Facility will operate 24 hours per day, 365 day per year in the hybrid (solar and fossil) or fossil only modes of operation. High reliability, a definite requirement for Frasch process sulfur mining as well as other industrial process heat operations, is incorporated into the design. DOE

N82-23768# General Electric Co., Philadelphia, Pa. Advanced Energy Programs Dept.
TEXASGULF SOLAR COGENERATION PROGRAM. VOLUME 2: APPENDICES Final Report
D. J. Bisantz 1 Jun. 1981 96 p refs
(Contract DE-AC03-80SF-11437)
(DE82-001848; DOE/SF-11437/T4-Vol-2) Avail: NTIS HC A05/MF A01

The subsystem characteristics and required operating modes for a solar cogeneration facility to be located at a Texas sulfur mine are specified. Cost estimates for six storage system concepts are summarized, and the costs of storage media are tabulated. Data for use in estimating the cost of storage tanks, and heat exchangers and a methodology for estimating indirect costs are given. The cartesian coordinates of each of the 588 heliostats in the collector field are given. A water steam receiver loss computer program is listed. DOE

N82-23769# Applied Forecasting and Analysis, Inc., Los Angeles, Calif.
DEMAND 80/81: FORECASTS OF ENERGY CONSUMPTION TO THE YEAR 2000. VOLUME 1: FORECASTS AND DESCRIPTION OF THE FORECASTING MODEL Final Report
A. M. Borges and R. T. Crow Oct. 1981 120 p refs 2 Vol.
(EPRI Proj. 1747-1)
(DE82-900871; EPRI-EA-2078-Vol-1) Avail: NTIS HC A06/MF A01

National forecasts of end use consumption of electricity, liquid hydrocarbons, gaseous hydrocarbons, and coal are presented. The forecasts are based on an econometric model whose equations represent energy consumption of each form of energy in each end use sector. Each forecast is conditional upon a common forecast of long run economic growth, coupled with a scenario concerning energy prices and conservation policy. The scenarios are composed of four alternative sets of assumptions about energy

prices and three alternative sets of assumptions on conservation policy. DOE

N82-23770# Applied Forecasting and Analysis, Inc., Los Angeles, Calif.
DEMAND 80/81: FORCASTS OF ENERGY CONSUMPTION TO THE YEAR 2000. VOLUME 2: APPENDIXES Final Report
A. M. Borges, C. M. Boyce, and R. T. Crow Oct. 1981 203 p 2 Vol.
(EPRI Proj. 1747-1)
(DE82-900870; EPRI-EA-2078-Vol-2) Avail: NTIS HC A10/MF A01

The forecasts cover each sector of the economy and are conditional upon alternative assumptions concerning national economic growth, energy prices, other prices, and conservation policy. The forecasts also include forms of energy other than electricity to provide a comprehensive energy picture. Although the forecasts proceed through time in one-year increments, their primary focus is on the period from 1985 to 2000. DOE

N82-23771# Acres American, Inc., Buffalo, N.Y.
PRELIMINARY DESIGN STUDY OF UNDERGROUND PUMPED HYDRO AND COMPRESSED-AIR ENERGY STORAGE IN HARD ROCK. VOLUME 11: PLANT DESIGN. UPH Final Report
Jun. 1981 379 p ref Prepared in cooperation with Potomac Electric Power Co. 13 Vol.
(Contract DE-AC02-77ET-28012; EPRI Proj. 1981-1)
(DE82-000918; EPRI-EM-1589-Vol-11; DOE/ET-5047/11) Avail: NTIS HC A17/MF A01

The plant design for an underground pumped hydroelectric (UPH) storage facility having maximum generating capacity of 2000 MW and energy storage capacity of 20,000 MWh at a nominal heat of 5000 ft. is presented. The UPH facility is a two step configuration with single-stage reversible pump-turbines, each step consisting of a 1000 MW plant at a nominal head of 2500 ft. The surface facilities and upper reservoir, shafts and hoists, penstocks and hydraulic tunnels, powerhouses, and intermediate and lower reservoirs are described. Details of the power plant electrical and mechanical equipment, including pump-turbine and motor-generator units, are given. The development of the site is outlined together with the construction methods and schedule. The cost estimates and a cost-risk analysis are presented. Plant operation, including unit operation, two-step operation, plant efficiency, and availability, is outlined. T. M.

N82-23772# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL EXECUTIVE SUMMARY. VOLUME 2: FOR LOVINGTON SQUARE SHOPPING CENTER, LOVINGTON, NEW MEXICO
Oct. 1981 7 p refs Prepared for Sandia National Labs. 3 Vol.
(Contract DE-AC04-76DP-00789)
(DE81-003081; SAND-81-7099/2-Vol-2) Avail: NTIS HC A02/MF A01

For the month of July 1981, the daily and monthly insolation, daily and monthly electricity production, and monthly array efficiency are given for a 100 kW photovoltaic flat panel. The facility was located at a New Mexico shopping center. (LEW) DOE

N82-23773# Boeing Computer Services, Inc., Seattle, Wash.
INTERMEDIATE PHOTOVOLTAIC SYSTEM APPLICATION EXPERIMENT OPERATIONAL EXECUTIVE SUMMARY. VOLUME 3: FOR NEWMAN POWER STATION, EL PASO, TEXAS
Oct. 1981 7 p refs Prepared for Sandia National Labs. 3 Vol.
(Contract DE-AC04-76DP-00789)
(DE82-003088; SAND-81-7100/3-Vol-3) Avail: NTIS HC A02/MF A01

For the month of August 1981, the daily and monthly insolation, daily and monthly energy production, and monthly array efficiency are given for a 20 kW photovoltaic flat panel power system. The panel system is for an uninterruptable power supply load at a Texas utility. (LEW) DOE

N82-23774*# Silicon Technology Corp., Oakland, N. J.
DEVELOPMENT OF METHODS OF PRODUCING LARGE AREAS OF SILICON SHEET BY THE SLICING OF SILICON INGOTS USING INSIDE-DIAMETER (I.D.) SAWS Final Report, May 1979 - Apr. 1980
Peter Aharonyan 1980 27 p Sponsored by NASA-JPL and DOE
(Contract NAS7-100; JPL-95531)
(NASA-CR-168435; DOE/JPL-955131-81-2; NAS 1.26:168435) Avail: NTIS HC A03/MF A01 CSCL 10A

Inside diametar wafering equipment, blades and processes were used to develop methods to produce large areas of silicon sheet. Modifications to a 16 inch STC automated saw included: programmable feed system, crystal rotating system, and STC dynatrack blade monitoring and control system. By controlling the plating operation and by grinding of the cutting edge, 16 inch ID blades with a cutting edge thickness of .22 mm can be produced. Crystal rotation mechanism was used to slice 100 mm diameter crystals with a 16 inch blade down to a thickness of .20 mm. Cutting rates with crystal rotation were generally slower than with standard plunge ID slicing techniques. Using programmed feeds and programmed rotation, maximum cutting rates were from 0.3 to 1.0 inches per minute. DOE

N82-23775# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
GENERAL INTRODUCTION TO WIND ENERGY CONVERSION
O. deVries Apr. 1981 128 p refs Presented at Von Karman Inst. for Fluid Dyn. Lecture Series No. 9 on Wind Energy Conversion Devices, Rhode-Saint-Genese, Belgium, 1-5 Jun. 1981
(NLR-MP-81014-U) Avail: NTIS HC A07/MF A01

Wind turbine and wind concentrator concepts are reviewed and the aerodynamic characteristics of wind turbines are discussed. The parameters which determine choice of conversion scheme, e.g., wind data, turbine control, conversion system, structural, dynamic and cost aspects, and environmental impediments, are considered. Design criteria are surveyed and the desirability of formulating building codes for wind energy conversion projects is stressed. Author (ESA)

N82-23776# Department of Energy, Washington, D. C. Office of Energy Markets and End Use.
RESIDENTIAL ENERGY CONSUMPTION SURVEY (RECS): HOUSEHOLD SCREENER SURVEY, 1979-1980, HOUSEHOLD CHARACTERISTICS AND ANNUALIZED CONSUMPTION SHOPPERS GUIDE
Phillip Windell Aug. 1981 59 p
(PB82-114885; DOE/DF-81/26A) Avail: NTIS HC A04/MF A01 CSCL 10A

This document is intended to serve as a general introduction to the data from the Household Screener Survey of the Residential Energy Consumption Survey (RECS) which is available to the public on machine-readable magnetic tape. The document includes an overview of the RECS and Household Screener Survey, brief descriptions of each of the files included on the tape, and a list of the variables in the main data set. Appended to this document are copies of the field work instruments used in the Household Screener Survey. The RECS data tapes are also accompanied by a Users' Guide which contains detailed specifications for the tape and each of the data files. GRA

N82-23777# Department of Energy, Washington, D. C. Office of Energy Markets and End Use.
RESIDENTIAL ENERGY CONSUMPTION SURVEY (RECS): HOUSEHOLD SCREENER SURVEY, 1979-1980, HOUSEHOLD CHARACTERISTICS AND ANNUALIZED CONSUMPTION
Phillip Windell Aug. 1981 62 p
(PB82-114893; DOE/DF-81/026B) Avail: NTIS HC A04/MF A01 CSCL 10A

This document provides basic information and technical specifications necessary for using the machine-readable magnetic tape containing data from the Household Screener Survey of the Residential Energy Consumption Survey (RECS). Included in this document are an overview of the RECS and a brief description of the Household Screener Survey. The next section contains

technical specifications for reading the tape and descriptions of the contents of each of the files contained on the tape. The remaining four sections are devoted to technical topics of special interest to users of the data. Appended to this document are copies of the fieldwork instruments used in the survey and a listing of the contents of a portion of the SPSS labels information. GRA

N82-23778# Department of Energy, Washington, D. C. Office of Energy Markets and End Use.
RESIDENTIAL ENERGY CONSUMPTION SURVEY (RECS): NATIONAL INTERIM ENERGY CONSUMPTION SURVEY, 1978-1979. HOUSEHOLD MONTHLY ENERGY CONSUMPTION AND EXPENDITURES. USER'S GUIDE
Phillip Windell Aug. 1981 60 p
(PB82-114919; DOE/DF-81/027A) Avail: NTIS HC A04/MF A01 CSCL 10A

Technical specifications and basic information necessary for the appropriate use of the machine readable magnetic tapes containing data from the National Interim Energy Consumption Survey. Household monthly energy consumption and expenditures records of the residential energy consumption survey are provided. Included are an overview of the Residential Energy Consumption Survey (RECS) effort as a whole and a brief description of this administration of the RECS, the National Interim Energy Consumption Survey. Technical specifications for reading the tapes and descriptions of the contents of each of the files contained on the tape are given. T.M.

N82-23779# Department of Energy, Washington, D. C. Office of Energy Markets and End Use.
RESIDENTIAL ENERGY CONSUMPTION SURVEY (RECS): NATIONAL INTERIM ENERGY CONSUMPTION SURVEY, 1978-1979, HOUSEHOLD MONTHLY ENERGY CONSUMPTION AND EXPENDITURES. SHOPPER'S GUIDE
Phillip Windell Aug. 1981 27 p
(PB82-114927; DOE/DF-81/027B) Avail: NTIS HC A03/MF A01 CSCL 10A

The data from the National Interim Energy Consumption Survey (NIECS) is available to the public on machine readable magnetic tapes. Brief overviews of the Residential Energy Consumption Survey as a whole and of the NIECS in particular is a brief description of each of the files included in this tape, and a list of the variables in the data set are included. A copy of the fuel supplier record form used to collect consumption and expenditure data for each of the sample households is also included. T.M.

N82-23780# D'Appolonia (E.) Consulting Engineers, Inc., Pittsburgh, Pa.
GEOTHERMAL ENERGY MARKET STUDY ON THE ATLANTIC COASTAL PLAIN: OCEAN CITY, MARYLAND GEOTHERMAL ENERGY EVALUATION
Carl E. Schubert Aug. 1981 53 p refs Prepared for Applied Physics Lab, Laurel, Md.
(Contracts EX-78-A-38-1008; DE-AI01-79ET-27025)
(PB82-123050; JHU/APL/QM-81-109) Avail: NTIS HC A04/MF A01 CSCL 13A

Thermal energy benefits for a proposed recreational complex are discussed. Resource potential, resource utilization, costs, economics, feasibility are considered. An operation scenario is included. N.W.

N82-23781# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
ENERGY PROGRAMS AT THE JOHN HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Apr. - Jun. 1981
Jul. 1981 37 p refs Sponsored in part by DOE
(PB82-126699; JHU/APL/EQR/81-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Efforts in geothermal energy development planning and technical assistance, energy conversion and storage techniques, siting of critical facilities, magnetic fusion and mathematical models of fires are briefly described. GRA

N82-23782# National Bureau of Standards, Washington, D.C. National Engineering Lab.
VALIDATION AND ASSESSMENT OF ENERGY MODELS. PROCEEDINGS Final Report
Saul I. Gass, ed. Oct. 1981 262 p refs Proceedings of symp. held at Gaithersburg, Md., 19-21 May 1980 Sponsored in part by DOE
(PB82-123951; NBS-SP-616; LC-81-6000087) Avail: NTIS HC A12/MF A01 CSCL 10A

The symposium was organized with a two fold agenda to summarize the recent ideas and advances of model validation and assessment that have been applied to DOE energy models, and to hold workshops on key open questions that are of concern to the validation and assessment research community. Speakers addressed current and future practices, the EIA model validation program, model structure and data, and model credibility. Full day workshop sessions were held on the following topics: validating composite models, the measurement of model confidence, model structure and assessment, sensitivity and statistical analysis of models, and model assessment methodologies.

N82-23783# California Energy Commission, Sacramento.
ENERGY TOMMORROW: CHALLENGES AND OPPORTUNITIES FOR CALIFORNIA Biennial Report, 1981
Jul. 1981 216 p refs
(PB82-117821; CAEC-75) Avail: NTIS HC A10/MF A01 CSCL 10A

The California Energy Commission presents its views on the critical energy issues for California in the next twenty years along with its official electricity demand forecast and assessments of other energy demand growth. Demand is compared to estimates of the potential contributions of conservation and various conventional and alternative energy supply projects. California's overdependence on oil is discussed and options for reducing petroleum use, particularly in the transportation sector were examined. The result is a series of policy recommendations for directing public and private investments into a diversity of energy options and for spreading the benefits and costs of these options broadly and fairly among California's citizens. T.M.

N82-23784# Department of Energy, Washington, D. C. Energy Information Administration.
STATE ENERGY DATA REPORT: STATISTICAL TABLES AND TECHNICAL DOCUMENTATION 1960 THROUGH 1979
Sep. 1981 530 p
(PB82-119470; DOE/DF-81/037A) Avail: NTIS HC A23/MF A01 CSCL 10A

All the data of the State Energy Data System (SEDS) is given. The data is used to estimate annual energy consumption by principal energy sources (coal, natural gas, petroleum, electricity), by major end-use sectors (residential, commercial, industrial, transportation, and electric utilities), and by state (50 states, the District of Columbia, and the United States). Data is organized alphabetically by energy source (fuel), by end-use sector or energy activity, by type of data and by state. Twenty data values are associated with each fuel-sector-type state grouping representing positionally the years 1960 through 1979. Data values in the file are expressed either as physical units, British thermal units, physical to Btu conversion factors or share factors. GRA

N82-23785*# National Bureau of Standards, Washington, D.C. Center for Materials Science.
DETECTION, DIAGNOSIS AND PROGNOSIS: CONTRIBUTION TO THE ENERGY CHALLENGE: PROCEEDINGS OF THE MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP Final Report
T. Robert Shives, ed. and William A. Willard, ed. Oct. 1981 341 p refs Conf. held in Santa Monica, Calif., 7-9 Oct. 1980 Sponsored in part by NASA, ONR, and Naval Air Systems Command
(NASA-CR-168713; NAS 1.26:168713; PB82-120304; NBS-SP-622; LC-81-600125) Avail: NTIS HC A15/MF A01 CSCL 10A

The contribution of failure detection, diagnosis and prognosis to the energy challenge is discussed. Areas of special emphasis included energy management, techniques for failure detection in energy related systems, improved prognostic techniques for energy

related systems and opportunities for detection, diagnosis and prognosis in the energy field. GRA

N82-23786# Great Plains Agricultural Council, Lincoln, Nebr. Committee on Social and Economic Implications of Energy Extraction, Conversion and Transportation
NATIONAL INTERREGIONAL COAL MODELS: PROCEEDINGS ON A WORKSHOP
John W. Green, ed. Oct. 1981 275 p refs Workshop held in Bozeman, Mont., 26-27 Jul. 1979
(PB82-120932; GPAC-93; EPA-600/9-80-042) Avail: NTIS HC A12/MF A01 CSCL 10A

The Great Plains Agricultural Council's Committee on Social and Economic Implications of Energy Extraction, Conversion and Transportation (GPC-8) organized and cosponsored with the Old West Regional Commission a Workshop on National Interregional Coal Models in Bozeman, Montana on July 26-27, 1979. Detailed information on six large-scale coal models were presented at the workshop. GRA

N82-23787# National Weather Service, Salt Lake City, Utah.
PRELIMINARY ESTIMATES OF WIND POWER POTENTIAL AT THE NEVADA TEST SITE
Howard G. Booth Jul. 1981 19 p refs Prepared in cooperation with National Weather Service, Las Vegas, Nev.
(PB82-127036; NOAA-TM-NWS-WR-166) Avail: NTIS HC A02/MF A01 CSCL 10A

An assessment of the potential for the useful conversion of wind power to electrical power is given for a Nevada test site. Annual wind power availability was estimated to be sufficient. The percentage of low wind hours was found to be high, and the persistence of favorably strong winds for periods of several days at a time was low. There was a pronounced diurnal cycle in wind power availability. It is concluded that baseload electrical power requirements would require alternate energy sources. Cost effectiveness of this configuration would have to be determined. R.J.F.

N82-23788# Arkansas Univ., Fayetteville.
ANALYSIS AND MODELING OF SOLAR ENERGY DATA FROM THE MISSISSIPPI COUNTY COMMUNITY COLLEGE SITE, BLYTHEVILLE, ARKANSAS Ph.D. Thesis
Abdulaziz Mohammad Mujahid 1981 171 p
Avail: Univ. Microfilms Order No. 8127221

A meteorological monitoring station was operated at Blytheville, Arkansas from April 1978 to April 1980. The station was located at the site of the Mississippi County Community College, and measured direct normal insolation, global, and diffuse sky radiation. From these data, five hourly solar radiation models were developed. The first model is a total horizontal solar radiation model developed as a function of both cloud cover the solar altitude angle. The second model is a direct normal solar radiation model, which is also dependent on both cloud cover and solar altitude angle. The third model developed is a direct normal model, which uses the measured total horizontal insolation as the independent variable and the solar altitude angle as a parameter. The fourth model is a diffuse sky radiation model, which is dependent on the measured global insolation. The fifth model developed involves the use of instantaneous correction factors to be applied to diffuse sky measurements made with a pyranometer equipped with a shadow band. Dissert. Abstr.

N82-23361*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DEPLOYMENT/RETRACTION GROUND TESTING OF A LARGE FLEXIBLE SOLAR ARRAY
Darius T. Chung *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 249-263 (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N82-23789# Washington State Univ., Pullman.
MATHEMATICAL MODELING OF OXIDANT PRODUCTION IN PLUMES Ph.D. Thesis
Kumaraswamy Ganesan 1981 137 p
Avail: Univ. Microfilms Order No. 8129968

Photochemical oxidant models provide one technique for studying the functional relationships between ozone and the two main classes of oxidant precursors, hydrocarbons and nitrogen oxides. A trajectory model capable of accurately predicting oxidant concentrations in an urban plume was developed. The chemical kinetic mechanism utilized in the model consists of a set of 36 reactions. The model also accounts for volume increase due to mixing layer growth, for entrainment from aloft and for surface loss due to dry deposition. The Houston urban plume was selected for modeling because a large amount of ambient data was available. Ambient pollutant concentrations measured at a sampling site located at the downwind edge of the Houston urban area were used for establishing initial concentrations in the plume. The model predicts oxidant concentrations in the plume along the wind trajectory. Dissert. Abstr.

N82-23790# TRC Environmental Consultants, Inc., Wethersfield, Conn.
VENTILATION/ODOR FIELD STUDY, VOLUME 1 Final Report
R. A. Duffee and P. Jann Apr. 1981 67 p refs Prepared for California Univ., Berkeley. Lawrence Berkeley Lab.
(Contract W-7405-eng-48)
(LBL-12632; EEB-Vent-81-10-Vol-1) Avail: NTIS HC A04/MF A01

The results of field studies conducted to explore the potential for saving energy by reducing ventilation rates in public buildings are given. Two types of experiment programs were initiated to determine the validity of earlier findings (chamber experiments from the 1930's) based on today's personal hygiene standards and using modern analytical facilities and techniques of psychophysical evaluation. The work consisted of measuring the actual fresh air ventilation in some public buildings, evaluating the indoor odors, and determining whether or not a reduction in ventilation rate results in a significant increase in odors. The relation between organic compounds, including odorants, and ventilation rate was also measured in-situ in selected buildings. Ventilation rates were measured using a sulfur hexafluoride tracer technique employing a gas chromatograph. Acceptability of the indoor air quality was measured by administrating questionnaires to building visitors. R.J.F.

N82-23791# Mound Lab., Miamisburg, Ohio.
POTABLE WATER STANDARDS PROJECT Final Report
Clarence E. Styron and Herbert E. Meyer 7 Apr. 1981 212 p refs
(Contracts DE-AC04-76DP-00053; EY-76-C-04-0053)
(MLM-2819) Avail: NTIS HC A10/MF A01

The pollution of drinking water with tritium discharges from a nuclear power plant is discussed. Waste disposal practices are described. Management of tritiated wastes is discussed. Approaches to resolving the tritium pollution problem are discussed in light of Federal pollution standards that are now being exceeded. The effects on the local aquifer and proposed efforts to clean it up are discussed. R.J.F.

N82-23792# Argonne National Lab., Ill.
STIBINE/ARSINE MONITORING DURING EV OPERATION. PRELIMINARY TESTS AT ANL AND AT LILCO Near-Term EV Battery Project
R. O. Loutfy, D. G. Graczyk, R. Varma, E. R. Hayes, F. L. Williams, and N. P. Yao Feb. 1981 80 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-81-1) Avail: NTIS HC A05/MF A01

A series of tests was performed to monitor the evolution and dispersal of stibine and arsine from lead-acid propulsion batteries in three different Electra-Van Model 600 vehicles. Ambient air was sampled at several locations inside the vehicles and in the garages where testing was done during charge, equalization charge, and on-the-road discharge operations. In addition, direct sampling of cell off-gases was performed with the van. Interpretation of the individual test results was carried

out in the context of vehicle characteristics, sampling protocol, and operating conditions. The test results demonstrated that under the test conditions only small concentrations of stibine and arsine accumulated in occupiable work areas. Measured concentrations in the vehicles and in the garages never exceeded 25 percent for the threshold limit value-time weighted average standards. Thus, although the potential for hazardous accumulation of the hydrides exists, it can be easily controlled. B.W.

N82-23793# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Service Div.
ENVIRONMENTAL MONITORING REPORT OF THE LAWRENCE BERKELEY LABORATORY, 1980 Annual Report
Gary E. Schleimer, ed. Apr. 1981 33 p refs
(Contract W-7405-eng-48)
(LBL-12604) Avail: NTIS HC A03/MF A01

The environmental monitoring program of the Lawrence Berkeley Laboratory is described. Data for 1980 are presented and general trends are discussed. Airborne and waterborne radionuclides are discussed. The radiation dose on the surrounding population is discussed. R.J.F.

N82-23794# Department of Energy, Washington, D. C.
ENVIRONMENTAL READINESS DOCUMENT. INDUSTRIAL PROGRAMS, FISCAL YEAR 1980
Feb. 1981 175 p refs
(DOE/ERD-0031) Avail: NTIS HC A08/MF A01

The environmental readiness of nine technologies under development are discussed. The technologies are: heat pump grain drying, blended cement, acetylene from coal, polypropylene waste to fuel oil, foam drying textiles, microwave and vacuum drying, fuel saving paint plant, new fertilizer process, and high performance forge furnace. Environmental considerations relevant to each technology are discussed. Pollution control, occupational health and safety, and conformity to environmental regulations are discussed. R.J.F.

N82-23795# Defence Research Information Centre, Orpington (England).
DETERMINATION OF LEAD, CADMIUM, COPPER AND ZINC IN GROUND WATER AND TAP WATER BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY
Fritz H. Frimmel and Angelika Immerz 30 Apr. 1980 18 p refs Transl. into ENGLISH from Fresenius z. Anal. Chem. (Germany), no. 302, 1980 p 364-369
(DRIC-T-6519; BR81972) Copyright. Avail: NTIS HC A02/MF A01

An alternative to atomic absorption spectroscopy (AAS) determination of heavy metals in ground and tap water is outlined. Differential pulse anodic stripping voltammetry (DPASV), involves a concentration process (reduction of dissolved metal ions to metal, employing a negative potential and concentration in the drops of mercury) and measurement. Measurement follows a rest period. The negative potential is allowed to become positive, with simultaneous resolution of the metals by oxidation. Measurements are made with a polarographic analysis system and an electrode stand. Concentrations down to 0.1 micro g/l are detectable. Accuracy of DPSAV is comparable to that of AAS. Values obtained with stagnant cold water are 3 to 10 times higher than minimum concentrations for water from a running faucet. Running faucet values are two to five times higher than ground water values. Author (ESA)

N82-23796# Defence Research Information Centre, Orpington (England).
DETERMINATION OF ATP AND THE KINETICS OF OXYGEN CONSUMPTION IN WASTE WATER
M. Andre, P. VanBeneden, and J. Bassleer Jan. 1982 14 p refs Transl. into ENGLISH from La Tribune du Cebedeau (France), nos. 415-416, 1978 p 251-256
(DRIC-T-6554; BR82033) Copyright. Avail: NTIS HC A02/MF A01

The kinetics of O2 consumption based on biological oxygen demand (BOD) and ATP production from microbial organisms isolated on a membrane were investigated. Two surface waters contaminated by silo effluents and two stretches of water sampled in an urban and industrial water collector were studied. The participation of two types of microbial population in biodegradation is considered. All BOD curves show a lag phase, with flora requiring one day to reach the logarithmic growth phase. Production of ATP peaks on the third day. The kinetics of O2 consumption and ATP production can be superimposed only up to the third day. Biomass decrease is ruled out since oxygen consumption is maintained. Observation supports the hypothesis that bacterial action ends after 36 hrs and, predatory protozoa develop, which multiply and feed on the bacteria. Author (ESA)

N82-23797# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
ATMOSPHERIC DIFFUSION LAWS OF TRITIUM AND TRITIATED WATER
Geard Bardolle Feb. 1981 82 p refs In FRENCH
(CEA-N-2187) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

Experimental data are presented on the atmospheric diffusion of tritium and tritiated water. Seven releases of tritium were studied on the Moronvilliers site from April 6 to April 17, 1970. Each release was associated with a release of the disodic salt of fluorescein. The results obtained air in good agreement except in the case of an instantaneous release of gaseous tritium. It was shown that the gaseous tritium released in the atmosphere is converted into tritiated water with half life lower than 30 minutes. DOE

N82-23798# Bioassay Systems Corp., Woburn, Mass.
DEVELOPMENT OF ENVIRONMENTAL ASSESSMENT SCREENING CRITERIA FOR COAL-CONVERSION SOLID WASTES Technical Progress Report, 1 Jul. - 30 Sep. 1981
Z. Reuveny and D. M. Hanson Sep. 1981 11 p refs
(Contract DE-AC22-80PC-30098)
(DE82-000751; DOE/PC-30098/T3) Avail: NTIS HC A02/MF A01

The preparation of extracts from each of the three waste test samples from the Ft. Lewis solvent refined coal 2 pilot plant was completed as well as most of the health and ecological tests which comprise the test battery. The extraction procedures and the tests performed on the extracts are being evaluated and reassessed. DOE

N82-23799# Meteorology Research, Inc., Santa Rosa, Calif.
AIRCRAFT DATA SUMMARIES FOR THE SURE INTENSIVES Final Report
W. S. Keifer, D. L. Blumenthal, J. B. Tommerdahl (Research Triangle Inst., Research Triangle Park, N.C.), J. A. Anderson, J. A. McDonald, R. B. Strong (Research Triangle Inst., Research Triangle Park, N.C.), and J. H. White (Research Triangle Inst., Research Triangle Park, N.C.) Sep. 1981 156 p refs Sponsored by EPRI
(DE82-900312; EPRI-EA-1910-V0l-3) Avail: NTIS HC A08/MF A01

Air quality sampling programs in the eastern United States using instrumented aircraft are described. The air quality and meteorological data obtained during January/February 1978 near the Duncan Falls, Ohio, and near Lewisburg, Virginia, are given. Sampling data are presented for all measured parameters. DOE

N82-23800# Sandia Labs., Livermore, Calif
CHARACTERIZATION OF THE CORROSION ENVIRONMENT OF THE DESERT NEAR BARTSTOW, CALIFORNIA
D. A. Hughes Sep. 1981 30 p refs
(Contract DE-AC04-76DP-00789)
(DE82-003876; SAND-81-8252) Avail: NTIS HC A03/MF A01

The corrosion characteristics of the desert atmosphere environment near Barstow, CA were evaluated for the solar pilot plant receiver panel. Potential degradation mechanisms considered were not corrosion from molten salts and stress corrosion cracking in aqueous environments. The possibility of degradation from these mechanisms depends on the chemical composition of airborne particulates, aerosols, and gases. These particulates and aerosol were collected near the pilot plant site and analyzed for water and acid soluble Na(+), Mg(++), Li(+), S(--), SO4(--), and Cl(-). Comparison and evaluation of the quantities of these ions present with those necessary for corrosion indicate that

external corrosion of the receiver due to the desert atmosphere environment is unlikely. DOE

N82-23801# Systems Applications, Inc., San Rafael, Calif.
CONTROL OF NITROGEN OXIDES: ASSESSMENT OF NEEDS AND OPTIONS, TECHNICAL SUPPORT DOCUMENT. VOLUME 1: INTRODUCTION AND SUMMARY Final Report
S. R. Hayes Sep. 1981 35 p refs Sponsored by Electric Power Research Institute
(EPRI Proj. 1375)
(DE82-900980; EPRI-EA-2048-Vol-1) Avail: NTIS HC A03/MF A01

The significance of the pending NO(x) related regulatory changes is outlined, and implications for electric utility planning and siting are itemized. The key NO(x) related regulatory changes are outlined. The conclusions regarding possible NO(x) air quality modeling strategy, and the potential implications for utility planning of the pending regulatory changes are summarized. DOE

N82-23802# Systems Applications, Inc., San Rafael, Calif.
CONTROL OF NITROGEN OXIDES: ASSESSMENT OF NEEDS AND OPTIONS, TECHNICAL SUPPORT DOCUMENT. VOLUME 2: LEGISLATIVE AND REGULATORY ENVIRONMENT Final Report
D. R. Souten and W. R. Oliver Sep. 1981 124 p refs Sponsored by Electric Power Research Institute
(EPRI Proj. 1375)
(DE82-900968; EPRI-EA-2048-Vol-2) Avail: NTIS HC A06/MF A01

The regulatory and legislative forcing functions for NO sub x control of power plant emissions are discussed. The discussion of air pollution legislation centers around federal regulations although some consideration is given to the state/Federal relationship because the actions of both of these governments affect the NO sub x control policies of utilities. T.M.

N82-23803# Systems Applications, Inc., San Rafael, Calif.
CONTROL OF NITROGEN OXIDES: ASSESSMENT OF NEEDS AND OPTIONS, TECHNICAL SUPPORT DOCUMENT. VOLUME 4: MATHEMATICAL MODELING OF ATMOSPHERIC NO SUB X Final Report
S. R. Hayes Sep. 1981 147 p refs Sponsored by Electric Power Research Institute
(EPRI Proj. 1375)
(DE82-900970; EPRI-EA-2048-Vol-4) Avail: NTIS HC A07/MF A01

Information required by electric utility readers to contend with several pending NO sub x-related regulatory changes is presented. Major classes of mathematical models that might be used when assessing the NO2-related air quality and visibility impacts of a power plant are described. The regulatory needs for models are first discussed and classes of relevant models are identified for the various regulatory issues. Certain general characteristics, such as model formulation, spatial scale, and source configuration, strongly influence the modeling process. The various model classes are examined for these characteristics along with the following subjects: general usefulness, limitations, capabilities, data requirements, key sources of uncertainty, and evaluation/recommendation status. T.M.

N82-23804# Systems Applications, Inc., San Rafael, Calif.
CONTROL OF NITROGEN OXIDES: ASSESSMENT OF NEEDS AND OPTIONS, TECHNICAL SUPPORT DOCUMENT. VOLUME 6: APPLYING NO/SUB X/ AIR QUALITY MODELS Final Report
S. R. Hayes, C. Liu, H. Y. Holman, D. R. Souten, M. J. Hillyer, and J. P. Killus Sep. 1981 237 p refs 6 Vol.
(EPRI Proj. 1375)
(DE82-900969; EPRI-EA-2048-Vol-6) Avail: NTIS HC A15/MF A01

The use and choice of air quality models to assess the impacts of power plant emissions of nitrogen oxides is discussed. Simple Gaussian models and more refined reactive plume models are considered. The choice is seen to depend upon the specific circumstances and the regulatory issue being addressed as well as upon the resources required by the alternative models. Since general dicta for model choice are not possible, a case study approach is used to explain the choice through analogy. For each case study, four steps are outlined. Background material for basic reader orientation are presented, thus illustrating the types of information that must be assembled. The situation is visualized in air quality modeling terms. The selection of a suitable model or set of models is demonstrated with the use of a series of decision trees. Guidance is offered in identifying data needs and assessing data availability. DOE

N82-23805# Flow Research, Inc., Kent, Wash.
PERFORMANCE AND ECONOMIC ASSESSMENT OF AN IMPROVED ELECTROSTATIC PRECIPITATOR ELECTRODE DESIGN FOR FINE-PARTICULATE COLLECTION Technical Progress Report
1981 31 p refs
(Contract DE-AC03-81EV-10506)
(DE82-002132; DOE/EV-10506/T2;
FLOW-Communication-143) Avail: NTIS HC A03/MF A01

A laboratory facility was designed and constructed for testing the new wavy plate configuration for precipitator collection electrodes. Materials required for the test program were specified and ordered. Computer programs were prepared for making theoretical predictions of the collection behavior of wavy plates and for evaluating data taken during the test program. Tests are planned for conventional and wavy plates in order to complete the two proof-concept tasks. DOE

N82-23806# Combustion Engineering, Inc., Windsor, Conn.
ENVIRONMENTAL REPORT: COMBUSTION ENGINEERING/GULF STATES UTILITIES COMPANY FUEL GAS DEMONSTRATION PLANT, WESTLAKE, LOUISIANA Final Report
Sep. 1981 237 p refs Prepared in cooperation with Radian Corp., Austin, Tex.
(Contract DE-AC02-80CH-10047)
(DE82-004141; DOE/CH-10047/1) Avail: NTIS HC A11/MF A01

The environmental impact of the construction and operation of a coal gasification demonstration plant within the confines of an existing power plant site is predicted. Solid waste disposal is predicted to require less than 60 acres of land within the plant boundary over a 20 year period. Compared to the ongoing activities at the power plant site, the demonstration plant will have a very small impact. Impacts beyond plant boundaries will be very slight. No significant environmental impacts are anticipated to result from the construction, operation, or final disposition of the demonstration plant. DOE

N82-23807# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
MIDWAY HOUSE-TIGHTENING PROJECT: A STUDY OF INDOOR AIR QUALITY
Francis J. Offermann, John R. Girman, and Craig D. Hollowell 1981 33 p refs Sponsored in part by Bonneville Power Administration
(Contract W-7405-eng-48)
(DE82-000997; DOE/BP-63; LBL-12777; EEB-Vent-81-15) Avail: NTIS HC A03/MF A01

Measurements of effective leakage areas and average concentrations of nitrogen dioxide, formaldehyde, and radon, were made before and after special house-tightening retrofits. The average reduction in leakage area resulting from these retrofits was 32%. None of the pollutants measured before or after the retrofits, reached levels exceeding existing quidelines. The moderate increases in radon and formaldehyde concentrations observed are consistent with what would be expected from the estimated average decrease in air-exchange rates. Because the pre- and post-retrofit measurements involved only single, relatively short-term samples taken two months apart, uncertainties associated with the variability of source strength and occupant activities affecting ventilation remain and preclude any definitive conclusions. DOE

N82-23808# Meteorology Research, Inc., Santa Rosa, Calif.
AIRCRAFT DATA SUMMARIES FOR THE SURE INTENSIVES Final Report
D. L. Blumenthal, J. B. Tommerdahl, J. A. McDonald, R. B. Strong, and J. H. White Sep. 1981 169 p refs Prepared in

cooperation with Research Triangle Inst. 6 Vol.
(EPRI Proj. 862)
(DE82-900313; EPRI-EA-1910-Vol-2) Avail: NTIS HC A08/MF A01

As part of a sulfate regional experiment, six air quality sampling programs were conducted in the eastern United States using instrumented aircraft. The air quality and meteorological data obtained during the October 1977 sampling near Rockport, Indiana, and near Scranton, Pennsylvania are presented. Sampling data are presented for all measured parameters. DOE

N82-23809# Netherlands Energy Research Foundation, Petten.
INVESTIGATIONS INTO THE DYNAMICS OF AEROSOLS IN ENCLOSURES AS USED FOR AIR POLLUTION STUDIES
J. F. vandeVate Jul. 1980 170 p refs
(ECN-86) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

A model is given describing aerosol removal from enclosed spaces; boundary conditions are given for non-stirred deposition of aerosols by sedimentation and diffusion. Experimental results are presented for unheated dry enclosures, heated dry enclosures, enclosures with a heated pool of liquid, and smog chambers. DOE

N82-23810# Atomic Energy Board, Pretoria (South Africa). Isotopes and Radiation Div.
TRACE ELEMENTS IN AIRBORNE PARTICULATES IN SOUTH AFRICA
C. M. Vleggaar, D. Van As, J. L. Watkins, D. W. Mingay, R. B. Wells (Council for Scientific and Industrial Research, Pretoria, South Africa), A. B. Briggs (Council for Scientific and Industrial Research, Pretoria, South Africa), and C. W. Louw (Council for Scientific and Industrial Research, Pretoria, South Africa) Oct. 1980 72 p refs
(DE81-700252; PEL-274; ISBN-0-86960-7227) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

Airborne particulate materials were monitored continuously with calendar month sampling periods at 5 rural/background, 4 rural/developing/peri-urban, 6 urban and 7 industrial sites in South Africa. Concentrations of Al, Br, Ca, Cs, Cd, Cl, Co, Cr, Cu, Eu, Fe, K, Mg, Mn, Na, Ni, Pb, Rb, S, Sb, Sc, Se, Ti, V and Zn were determined with neutron activation analysis (NAA), atomic absorption spectroscopy (AAS) and particle-induced X-ray emission spectroscopy (PIXE) employed on a complementary basis. A review of sources of airborne trace elements is given. The monitoring program, sampling, sample-handling procedures, as well as the analytical methods used, are discussed in detail. The results of related studies, i.e., effects of filter materials, sampling rates and geometry, determinations of collection efficiencies, particle size ranges, effects of internal flux monitors on the precision and accuracy of NAA, trace impurities in blank materials, quality control by routine analysis of reference materials, and comparison of results obtained by NAA, AS, and PIXE analysis, are given, as is a review of air pollution control and research policy in South Africa and of ambient air quality standards. DOE

N82-23811# Oak Ridge National Lab., Tenn.
ANALYSIS OF ENVIRONMENTAL ISSUES RELATED TO SMALL-SCALE HYDROELECTRIC DEVELOPMENT. 5: INSTREAM FLOW NEEDS FOR FISHERY RESOURCES
J. M. Loar and M. J. Sales Oct. 1981 135 p refs
(Contract W-7405-eng-26)
(DE82-000901; ORNL/TM-7861) Avail: NTIS HC A07/MF A01

The growing recognition nationwide of the importance of protecting instream uses of water has coincided with the recent emphasis on the development of small-scale hydropower resources. The issue of instream flow maintenance in hydropower development is essentially a problem of evaluating the effects of planned modifications in hydrologic patterns. Because hydroelectric projects can alter natural flow regimes on both spatial and temporal scales, downstream water users, the aquatic ecosystem, and primarily fish, can be adversely affected. Numerous methods which differ in their use of hydrologic records, hydraulic simulation techniques, and habitat rating criteria were developed to assess the effects of stream flow regulation on aquatic biota and to provide instream flow recommendations. Consequently, guidance is needed to ensure that the most appropriate methods are selected for instream flow assessments at small-scale hydroelectric sites. DOE

N82-23812# Heraeus (W. C.) G.m.b.H., Hanau (West Germany). Produktbereich Chemie.
STUDY OF SO SUB 2 - EMISSION-PROBLEM IN SULFURIC ACID EQUIPMENTS Final Report
Heinz-Josef Brockmeyer and Rudolf Blaha Bonn Bundesministerium fuer Forschung und Technologie Dec. 1981 92 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-214; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19.30

A noble metal catalyst was developed in order to reduce SO2 emission of sulfuric acid production plants. The discrepancy in SO2/SO3 conversion yield between laboratory and field testing of a noble metal catalyst was investigated, with a view to catalyst poisoning. Catalyst poisoning turned out to be of minor importance. Noble metal migration and sintering are predominant under production conditions (bypass of a sulfuric acid production plant) and are therefore considered to be the main cause of catalyst deterioration and for the discrepancy between laboratory and field tests. The V2O5 catalyst is superior to the platinum catalyst. Further optimization of the platinum catalyst, using surface analytic measurements seems to be promising. Author (ESA)

N82-23813# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
MOBILE SOURCE EMISSIONS OF FORMALDEHYDE AND OTHER ALDEHYDES
Penny M. Carey May 1981 37 p refs
(PB82-118159; EPA/AA/CTAB/PA/81-11) Avail: NTIS HC A03/MF A01 CSCL 07D

The available vehicular aldehyde studies were summarized in an attempt to characterize aldehyde emissions from motor vehicles. Topics covered in these studies include aldehyde emission factors for unmodified and malfunction vehicle engine configurations, effects of fuel, mileage accumulation and temperature variations and aldehyde emissions from Diesel-equipped vehicles equipped with prototype light-duty Diesel oxidation catalysts. Thus, it was possible to obtain aldehyde data for standard conditions and for a variety of operating conditions. The Federal test procedure (FTP) was used for the light-duty vehicles and the 13-mode test procedure for the heavy-duty engines. The 2, 4 dinitrophenylhydrazine (DNPH) procedure was used for the sampling and analysis of the aldehydes. GRA

N82-23814# SRI International Corp., Menlo Park, Calif.
ANALYSES, EXPERIMENTAL STUDIES, AND EVALUATIONS OF CONTROL MEASURES FOR AIR FLOW AND AIR QUALITY ON OR NEAR HIGHWAYS, EXECUTIVE SUMMARY Final Report
Walter F. Dabbberdt Washington Federal Highway Administration Mar. 1981 28 p refs
(PB82-133596; FHWA/RD-81/053) Avail: NTIS HC A03/MF A01; also available in set of 4 reports HC E18 as PB82-133588 CSCL 13B

Experimental, analytical, and modeling studies of near-roadway pollutant transport and diffusion were conducted to meet the following two objectives: development of principles and guidelines for predicting and managing exhaust gas dispersion for various traffic conditions, winds, highway configurations, and topography, and determination of optimal design and operation of nearby areas and structures. Both wind tunnel and atmospheric monitoring were undertaken to evaluate a wide range of highway configurations that included grade-level, vertical-wall cut, slant wall cut, elevated, and hillside sections. A practical and versatile simulation model called ROADMAP was developed to simulate the distribution of pollutant concentrations near cut, grade-level, and elevated roadway sections. Comparison of model simulations with field observations shows good to excellent agreement. GRA

N82-23815# SRI International Corp., Menlo Park, Calif.
ANALYSES, EXPERIMENTAL STUDIES, AND EVALUATIONS OF CONTROL MEASURES FOR AIR FLOW AND AIR QUALITY ON AND NEAR HIGHWAYS. VOLUME 2:

USER GUIDELINES AND APPLICATIONS NOTES FOR ESTIMATING AIR QUALITY FOR ALTERNATIVE ROADWAY CONFIGURATIONS Final Report, 1973 - 1980
Walter F. Dabberdt Washington Federal Highway Administration Mar. 1981 134 p refs
(Contract DOT-FH-11-8125; SRI Proj. 2761-1)
(PB82-133612; FHWA/RD-81/052) Avail: NTIS HC A07/MF A01; also available in set of 4 reports HC E18 as PB82-133588 CSCL 13B

Guidelines are presented in four parts for the evaluation of air quality conditions at alternative roadway configurations. The first part presents a background discussion of principles of atmospheric dispersion and the emission of pollution (particularly carbon monoxide) by motor vehicles. In the second part the theory and application of the dispersion methodology is presented; the procedure is based on the roadway-atmospheric dispersion model of air pollution (ROADMAP). The applications of the methodology to some thirty site configurations in part three is intended to demonstrate the various tactical uses of the guidelines. The fourth part, on the other hand, presents some of the strategic considerations and limitations pertinent to the proper application of the guidelines for the purpose of air quality management. T.M.

N82-23816# SRI International Corp., Menlo Park, Calif.
ANALYSES, EXPERIMENTAL STUDIES AND EVALUATIONS OF CONTROL MEASURES FOR AIR FLOW AND AIR QUALITY ON AND NEAR HIGHWAYS. VOLUME 3: USER'S MANUAL FOR FHWA DATA BASE AND RETRIEVAL PROGRAMS Final Report
Daniel E. Wolf, Eugene Shelar, Ronald E. Ruff, and Walter F. Dabberdt Washington Federal Highway Administration Mar. 1981 81 p refs
(Contract DOT-FH-11-8125; SRI Proj. 2761)
(PB82-133620; FHWA/RD-81/054) Avail: NTIS HC A05/MF A01; also available in set of 4 reports HC E18 as PB82-133588 CSCL 13B

A comprehensive data base has been stored on magnetic tape. This data base was collected and used by SRI International in the development of a methodology for the description and management of the atmospheric resource (i.e., air quality) on the near roadways. Specifically, the data base contains parameters that are oriented toward understanding the interactive role played by vehicle traffic features, meteorological parameters, and roadway and adjacent building configurations in the transport and diffusion of pollutants on the local or microscale. This manual describes the content and format of this data base. It also presents sample program fragments that can be used to access the data base. GRA

N82-23817# Great Lakes Basin Commission, Ann Arbor, Mich.
GREAT LAKES BASIN PLAN: WETLANDS POLICY PLAN Final Environmental Impact Statement
Aug. 1981 53 p refs Sponsored in part by Water Resources Council, Washington, D.C.
(PB82-124991) Avail: NTIS HC A04/MF A01 CSCL 13B

The wetlands policy plan with environmental impact for the Great Lakes Region is described. Recommendations concerning wetlands inventories, incentive programs, and regulations are made. GRA

N82-23818# Great Lakes Basin Commission, Ann Arbor, Mich.
GREAT LAKES BASIN PLAN: COASTAL HAZARDS PLAN WITH FINAL ENVIRONMENTAL IMPACT STATEMENT Final Report
Aug. 1981 83 p refs Sponsored in part by the Water Resources Council
(PB82-125006) Avail: NTIS HC A05/MF A01 CSCL 13B

The coastal hazards plan with environmental impact statement for the Great Lakes Region is discussed. This plan incorporates these past efforts into a regional coastal hazards plan. The goal of this plan is to identify means to reduce current economic losses and environmental damages associated with coastal erosion and flooding, and prevent future losses and damages. GRA

N82-23819# Abt/West, Denver, Colo.
VISIBILITY BENEFITS ASSESSMENT GUIDEBOOK, EXECUTIVE SUMMARY Final Report
Robert D. Rowe and Lauraine G. Chestnut Aug. 1981 38 p (Contract EPA-68-02-3528)
(PB82-126137; EPA-450/5-81-002) Avail: NTIS HC A03/MF A01 CSCL 13B

The Executive Summary is a companion volume to the Visibility Benefits Assessment Guidebook. An overview of the major concepts and procedures covered by the guidebook is provided. The Visibility Benefits Assessment Guidebook provides a comprehensive and critical assessment of visibility benefits analysis as it exists today. The Guidebook describes the relationship between atmospheric chemistry, visual perception, and theoretical and applied welfare economics, and presents a description of the most promising methodologies for accomplishing benefits analysis. Case studies are also included. DOE

N82-23820# Abt/West, Denver, Colo.
VISIBILITY BENEFITS ASSESSMENT GUIDEBOOK Final Report
Robert D. Rowe and Lauraine G. Chestnut Aug. 1981 331 p refs
(Contract EPA-68-02-3528)
(PB82-126129; EPA-450/5-81-001) Avail: NTIS HC A15/MF A01 CSCL 13B

This guidebook presents concepts and techniques that can be used to estimate monetary benefits for changes in visibility aesthetics resulting from alternative levels of air pollution control. There are several defensible methodologies that can be used to place a monetary value on visibility aesthetics. This guidebook focuses upon this one aspect of air quality analysis, which can be combined with other aspects, such as health damages of air pollution and costs of emission controls to producers, to assist in policy decision making relating to air quality management. This guidebook introduces these benefit estimation techniques in recognition of the EPA's need to provide technical support to those who must evaluate impacts related to clean air regulations and in recognition that improved benefit measurement will lead to more accurate benefit cost analysis. GRA

N82-23821# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
BRIEF SYNOPSIS OF EPA OFFICE OF RESEARCH AND DEVELOPMENT AND THE HEALTH EFFECTS INSTITUTE MOBILE SOURCE WORK
May 1981 27 p refs
(PB82-124421; EPA/AA/CTAB/PA/81-10) Avail: NTIS HC A03/MF A01 CSCL 13B

The work in progress by ORD, the pertinent results, and future work planned by ORD are discussed. Some of the important areas mentioned are; chemical characterization work, development of method to collect gas-phase hydrocarbons in diesel exhaust, effect of NO2 in mutagen artifact generation, study of filter efficiency, and identification of types of compounds responsible for Ames test activity in diesel particles. T.M.

N82-23822# California Univ., Berkeley.
EFFECTS OF ACID RAIN ON PLANTS AND SOILS IN CALIFORNIA Final Report, 1 Jul. 1979 - 1 Jul. 1981
John G. McColl Sep. 1981 120 p refs
(PB82-122110; ARB-R-81/148) Avail: NTIS HC A06/MF A01 CSCL 13B

Effects of acid rain on some California plants and soils were studied. Plants growing in soil were treated with simulated rain on varying acidity. Direct foliar damage was not apparent, other than under extreme conditions which are not normally experienced in the field. Sugar beet was the most sensitive of the agronomic species tested. Germination of Douglas-fir seed was inhibited under severe acid conditions. Similarly, growth of two-year-old conifer seedlings showed little deleterious effects, except under most severe treatments. Acid rain affects plant productivity (positively and negatively), and the effect for a given input acid was largely predicted by the soil in which the plants were growing. A simple, reliable laboratory method was developed for determining potential sensitivity of soils to leaching by acid rain. Author (GRA)

N82-23823# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
THE DETERMINATION OF A RANGE OF CONCERN FOR

MOBILE SOURCE EMISSIONS OF HYDROGEN CYANIDE
Colleen L. DeMeyer and Robert J. Garbe Aug. 1981 39 p refs
(PB82-120098; EPA/AA/CTAB/PA/81-3) Avail: NTIS HC A03/MF A01 CSCL 13B

A methodology was developed specifically for an evaluation of hydrogen cyanide (HCN) emissions from mobile sources. Mathematical models were used to calculate the ambient air contractions resulting from various mobile source HCN emission factors (grams/mile). In conjection with this, an HCN health effects literature search was conducted to aid in the determination of the final range of concern. The results of the available emission factor data indicate that HCN emissions are not likely to present a problem to public health. Vehicles equipped with a three-way catalyst operating under malfunction modes or low ambient temperatures, may, make a greater contribution to any potential human exposure problem. GRA

N82-23824# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
DETERMINATION OF A RANGE OF CONCERN FOR MOBILE SOURCE EMISSIONS OF AMMONIA
Robert J. Garbe Aug. 1981 34 p refs
(PB82-120056; EPA/AA/CTAB/PA/81-20) Avail: NTIS HC A03/MF A01 CSCL 13B

A range of concern for ammonia (NH3) emissions from mobile sources is established. A methodology was developd in order to bracket a range of concern for various unregulated pollutants. This methodology is used specifically for an evaluation of NH3. Mathematical models were designed or adjusted for various exposure scenarios (such as enclosed spaces, expressways, and street canyons) and were used to calculate the ambient air concentrations resulting from various mobile source NH3 emission factors. In conjunction with this, an NH3 health effects literature search was conducted to aid in the determination of the final range of concern. GRA

N82-23825# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
AN APPROACH FOR DETERMINING LEVELS OF CONCERN FOR UNREGULATED TOXIC COMPOUNDS FROM MOBILE SOURCES
Robert J. Garbe Jul. 1981 42 p refs
(PB82-118167; EPA/AA/CTAB/PA/81-2) Avail: NTIS HC A03/MF A01 CSCL 13B

An approach for determining ranges of concern for vehicle emissions of toxic unregulated pollutants is discussed. This EPA technical effort is represented as one input that may bear on EPA policy with respect to implementation of section 202(a)(4) of the Clean Air Act amendments of 1977. This approach is helpful for automobile manufacturers, who are involved with deciding whether unregulated pollutants from motor vehicles constitute a public health hazard. An example of how the approach works is presented for a sample mobile source pollutant, sulfuric acid. Author (GRA)

N82-23826# Environmental Protection Agency, Ann Arbor, Mich. Control Technology Assessment and Characterization Branch.
THE DETERMINATION OF A RANGE OF CONCERN FOR MOBILE SOURCE EMISSIONS OF SULFURIC ACID
Craig A. Harvey and Robert J. Garbe Aug. 1981 29 p refs
(PB82-117870; EPA/AA/CTAB/PA/81-21) Avail: NTIS HC A03/MF A01 CSCL 13B

In light of the action called for in section 202(a)(4) of the Clean Air Act (CAA) and due to a concern within industry as to what emission levels will be used as the basis for the evaluation of current and future technologies, a methodology was developed in order to bracket a range of concern for various unregulated pollutants. The efforts from two EPA contracts are coordinated in order to use this methodology specifically for an evaluation of sulfuric acid. GRA

N82-23827# Minnesota Univ., Minneapolis.
AN ANALYSIS TECHNIQUE FOR MINERAL PLANNING Ph.D. Thesis
William Charles Brice 1981 774 p
Avail: Univ. Microfilms Order No. 8125935

A systematic interdisciplinary approach for evaluating many of the land use and environmental impacts associated with the potential development of a new mining district is discussed. The copper-nickel resource area of northeastern Minnesota is used to evaluate the implications of development commitments. This data system contains a computerized data base. Twenty-six mapped data inventories represent the environmental conditions in the study area. Computerized land use and environmental impact models and interpretations are developed for mineral potential, mineral resources, peat resource potential, mine facility site alternatives, mine facility site characteristics, engineering suitability, timber productivity, wildlife habitat potential, recreation suitability, and several other land and water impacts. Dissert. Abstr.

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N82-23828# Texas A&M Univ., College Station.
MECHANICAL PROPERTIES OF ULTRAFINE QUARTZ, CHLORITE AND BENTONITE IN ENVIRONMENTS APPROPRIATE TO UPPER-CRUSTAL EARTHQUAKES Ph.D. Thesis
Nigel Gordon Higgs 1981 286 p
Avail: Univ. Microfilms Order 8128896

Frictional deformation mechanisms in the context of earthquake prediction are investigated. Realistic hypocentral environments for upper crustal earthquakes were stimulated. The effects of temperature and pore water pressure are investigated in friction experiments simulating the environment expected along a fault between 5 and 10 km depth. Using a triaxial apparatus, thin layers of powders of quartz, chlorite and bentonite were sheared in Tennessee sandstone, dry at 150 MPa confining pressure, or wet at 250 MPa with a pore water pressure of 100 MPa. A constitutive model for frictional sliding is presented. It incorporates competing effects of creep at asperity contacts in response to both shear and normal tractions, and associated changes in real contact area. The model demonstrates that when the rate sensitivity of asperity creep normal to a frictional interface is greater than the rate sensitivity to shear, a negative net rate sensitivity can arise in the constitutive equation. Dissert. Abstr.

N82-23829# Minnesota Univ., Minneapolis.
A FULLY COUPLED THERMAL-MECHANICAL-FLUID FLOW MODEL FOR NONLINEAR GEOLOGIC SYSTEMS Ph.D. Thesis
Roger Dale Hart 1981 360 p
Avail: Univ. Microfilms Order No. 8125964

A single model is presented which describes fully coupled thermal-mechanical-fluid flow behavior of highly nonlinear, dynamic or quasistatic, porous geologic systems. The mathematical formulation for the model utilizes the continuum theory of mixtures to describe the multiphase nature of the system, and incremental linear constitutive theory to describe the path dependency of nonlinear material behavior. The model, incorporated in an explicit finite difference numerical procedure, was implemented in two different computer codes. A special-purpose one-dimensional code, SNEAKY, was written for initial validation of the coupling mechanisms and testing of the coupled model logic. A general purpose commercially available code, STEALTH, developed for modeling dynamic nonlinear thermomechanical processes, was modified to include fluid flow behavior and the coupling constitutive model. The fully explicit approach in the coupled calculation facilitated the inclusion of the coupling mechanisms and complex constitutive behavior. Dissert. Abstr.

N82-23830# Oklahoma Univ., Norman.
SOURCE ROCK GEOCHEMISTRY AND LIQUID AND SOLID PETROLEUM OCCURRENCES OF THE OUACHITA MOUNTAINS, OKLAHOMA Ph.D. Thesis
Joseph Anthony Curiale 1981 305 p
Avail: Univ. Microfilms Order No. 8129427

Crude oils, solid bitumens and potential oil source rocks of the frontal and central Ouachita Mountains of southeastern Oklahoma are examined. The organic matter in each of these materials is characterized, and oils are correlated to potential source rocks in the Ouachita Mountains. Four Ouachita Mountain oils and seven solid bitumens (grahamite and impsonite) are analyzed. The oils are paraffinic and range from 31.8 to 43.1 API gravity. The oils are thermally mature and generally unaltered. All four oils are commonly sourced, by n-alkane, sterane and hopane distributions, stable isotope ratios, infrared spectra and vanadium/nickel ratios. A common source for the solid bitumens is also suggested by isotope ratios and pyrolyzate characteristics. An origin due to crude oil biodegradation is suggested for these solids, based on carbon isotope ratios, elemental analyses, and sterane distributions of the solid bitumen pyrolyzates.
Dissert. Abstr.

N82-23831# Ohio State Univ., Columbus.
GEOCHRONOLOGY, GEOCHEMISTRY, AND PETROGENESIS OF BASALTIC ROCKS FROM THE WESTERN CASCADES, OREGON Ph.D. Thesis
Daniel R. Lux 1981 182 p
Avail: Univ. Microfilms Order No. 8129056

Basaltic rocks, representing the Columbia River Basalt Group (CRB) and Little Butte Volcanic Series (LBVS), from the western Cascades, Oregon are characterized in terms of age, chemistry, and Sr isotopic composition. Two CRB formations, Grande Ronde and Wanapum Basalts (both 15.3 + or - 0.4 Ma) were identified and a southern limit for CRB in the western Cascades is established at Hungry Hill 10 miles northeast of Lebanon. Units previously mapped as CRB near Lebanon and Sweet Home range in age from 40 to 25 Ma and thus more correctly belong to the LBVS. Basaltic rocks from the LBVS, both tholeiitic and calc-alkaline are recognized, range in age from 15 to 42 Ma with an apparent 5 Ma periodicity similar to that recognized in basalts and andesites of the western Cascades, Oregon which are less than 15 Ma in age. Major, trace, and rare earth element (REE) geochemistry suggests that the petrogenesis of CRB and LBVS tholeiites and calc-alkaline rocks involved extensive crystal fractionation. Dissert. Abstr.

N82-23832# Mississippi Univ., University.
THE THEORY AND GEOLOGICAL APPLICATION OF TERNARY STATISTICS Ph.D. Thesis
Daniel Howell Cooper 1981 106 p
Avail: Univ. Microfilms Order No. 8128094

A statistical procedure for defining the relationship of three interdependent variables was developed. A plotting scheme was devised which would reduce any three variable values to a single representative point. The centroid of a triangle formed by the three input values provided the best definition for such a point. Ternary statistical plots were made of geological data which were previously analyzed using conventional statistical and graphical methods. In instances where multiple plots were needed to define the correlation of three variables, ternary statistical analysis reduced the same correlation to a single plot. Ternary statistical plots emphasized features not shown on the conventional plots. Ternary statistical techniques provided a more complete and less complex approach. Dissert. Abstr.

N82-23833# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Physics.
THE INTERNATIONAL TURBULENCE COMPARISON EXPERIMENT (AUSTRALIA, 1976): CENTRAL CORE DATA
A. J. Dyer, J. R. Garratt, and R. J. Francey 1981 47 p refs
(Rept-38; ISBN-0-643-00383-5) Avail: NTIS HC A03/MF A01

Turbulence data for the International Turbulence Comparison Experiment during October, 1976 are presented. The data consist of: (1) spectral and cospectral of horizontal velocity, vertical velocity, temperature and humidity fluctuations for 30 equi-spaced logarithmic frequency intervals covering the frequency range 0.001 to 15 Hz approximately; (2) the standard deviation and covariance for three frequency bands and the whole frequency range. The standard deviation and covariance were measured by a number of instruments and instrument arrays were compared to assess their field performance and calibration accuracy. Satisfactory agreement was achieved, but only after consideration of: (1) instrumental response at high frequencies; (2) flow distortion induced by instruments and supporting structures; (3) spatial separation of instruments used for covariance measurements; and (4) statistical errors associated with single point measurement over a finite averaging time, and with lateral separation of two sensor arrays being compared. M.D.K.

N82-23834*# Alcorn State Univ., Lorman, Miss. Dept. of Industrial Education and Technology.
MEASUREMENT OF TOTAL ELECTRON CONTENT OF MIDLATITUDE IONOSPHERE AND PROTONOSPHERE VIA FARADAY ROTATION AND GROUP RELAY TECHNIQUES USING TRANSMISSION FROM GEOSTATIONARY SATELLITES ATS-3 AND ATS-6 Final Report
M. P. Paul 1 Apr. 1982 30 p refs
(Grant NGR-25-012-001)
(NASA-CR-168852; NAS 1.26:168852) Avail: NTIS HC A02/MF A01 CSCL 04A

Measurement of integrated columnar electron content and total electron content for the local ionosphere and the overlying protonosphere via Faraday rotation and group delay techniques has proven very useful. A field station was established having the geographic location of 31.5 deg N latitude and 91.06 deg W longitude to accomplish these objectives. A polarimeter receiving system was set up in the beginning to measure the Faradary rotation of 137.35 MHz radio signal from geostationary satellite ATS 3 to yield the integrated columnar electron content of the local ionosphere. The measurement was continued regularly, and the analysis of the data thus collected provided a synopsis of the statistical variation of the ionosphere along with the transient variations that occurred during the periods of geomagnetic and other disturbances. S.L.

N82-23835# Idaho National Engineering Lab., Idaho Falls.
RAFT RIVER GEOSCIENCE CASE STUDY: APPENDIXES
Max R. Dolenc, Laurence C. Hull, Steve A. Mizell, Brent F. Russell, Piotr A. Skiba, Jon A. Strawn, Julie A. Tullis, and Reeta Garber, ed. Nov. 1981 155 p refs 2 Vol.
(Contract DE-AC07-76ID-01570)
(DE82-003553; EGG-2125-Vol-2) Avail: NTIS HC A08/MF A01

The lithology, x-ray analysis, cores, and well construction data are presented. Borehole geophysical logs, chemical analyses from wells at the Raft River geothermal site, and a bibliography are included. T.M.

N82-23836# California Univ., Livermore. Lawrence Livermore Lab.
SOME EFFECTS OF STRESS, FRICTION AND FLUID FLOW ON HYDRAULIC FRACTURING
M. E. Hanson, G. D. Anderson, R. J. Shaffer, and L. D. Thorson Mar. 1981 31 p refs
(Contract W-7405-eng-48)
(DE82-001674; UCRL-85003; SPE/DOE-9381) Avail: NTIS HC A03/MF A01

A research program to understand the hydraulic fracturing process, especially those phenomena and parameters which strongly affect or control the fracture geometry was conducted. Theoretical and experimental studies consistently confirm the well known fact that in-situ stress has a primary effect on fracture geometry and that fractures propagate perpendicular to the least principal stress. It was found that frictional interfaces in reservoirs can affect fracturing. Some of the effects on fracture geometry due to frictional slippage along interfaces was quantified. Variation of friction along an interface can result in abrupt steps in the fracture path. These effects were seen in the mine back of emplaced fractures and are demonstrated both theoretically and in the laboratory. Further experiments and calculations are starting to indicate the possible control of the fracture height by the vertical change in the cables to X-608A wells should be replaced, and develop v across categories of persons affected. The management plan for the operation of the plant is also discussed. DOE

N82-23837# Sandia Labs., Albuquerque, N. Mex. In Situ Technologies Div.

EFFECT OF PULSE LOADS ON DYNAMIC ROCK FRACTURE

E. P. Chen Oct. 1981 27 p refs
(Contract DE-AC04-76DP-00789)
(DE82-002311; SAND-81-1942) Avail: NTIS HC A03/MF A01

An analytical model was developed which is capable of predicting the fracture pattern in the rock surrounding a wellbore upon which a dynamic loading pulse is applied. The development of the model followed the principle of elastodynamic fracture mechanics. Specifically, inherent cracks are assumed to exist around the edge of the wellbore. Depending on the pulse shape, these cracks are activated to form various fracture patterns. The criterion for initiation of crack growth is determined by the magnitude of the dynamic stress intensity factor associated with the crack. The finite element code HONDO was used to calculate the dynamic stress intensity factors. Analytical predictions were correlated with field experimental data and good agreements were found. DOE

N82-23838# Graz Univ. (Austria). Inst. fuer Nachrichtentechnik und Wellenausbreitung.

MEASUREMENT OF ELECTRIC FIELDS IN THE STRATOSPHERE [MESSUNG ELEKTRISCHER FELDER IN DER STRATOSPHAERE]

H. Slamanig Jun. 1981 34 p refs In GERMAN; ENGLISH summary
(INW-8107) Avail: NTIS HC A03/MF A01

A balloon-borne experiment for electric field measurement with data coding, small enough to be used in a combined payload simultaneously measuring, e.g., X-ray fluxes, is described. Measurement apparatus assembly is depicted. System integration is shown, including direction finder (azimuth), spin motor, and inertia real winch. Electronics design is given. Procedures for prelaunch payload preparation and launch checkout are covered. Author (ESA)

N82-23839# Graz Univ. (Austria). Dept. of Communications and Wave Propagation.

REFINEMENTS IN THE DERIVATION OF D REGION PLASMA DENSITIES BASED ON THE ROCKET-BORNE FARADAY EXPERIMENT

K. M. Torkar and M. Friedrich 1981 12 p refs
Avail: NTIS HC A02/MF A01

The principles of the Faraday experiment and an electrostatic probe are given together with the processing procedure necessary particularly in order to correct for payload attitude. The measurement principle is based on the doubly refractive properties of a magnetoplasma towards electromagnetic waves. Electron density and collision frequency are derived from the position and shape of the elliptical composite signal, resulting from the superposition of two circularly polarized emitted waves, rotating in opposite directions. The probe consists of a negatively biased sphere, inside a gridded sphere so as to repel electrons and negative ions. Current collection is a function of the relative velocity between the ions and the gridded sphere, its diameter, and ion density. Flight results show that after 69 sec at 1300 MHz the dominant modulation becomes omega and not 2 omega. The antiphase of the symmetry of the maxima of the two edge receivers (1300 and 7835 MHz) occurs at 66 sec. Author (ESA)

N82-23840*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ANTARCTIC METEORITE NEWSLETTER. VOLUME 4: NUMBER 1, FEBRUARY 1981: ANTARCTIC METEORITE DESCRIPTIONS, 1976, 1977, 1978, 1979

Roberta Stone, Carol M. Schwarz, Trude V. V. King, Brian Mason, Donald D. Bogard, and Elizabeth M. Gabel Feb. 1981 165 p Sponsored in part by NSF
(PB82-132952; JSC-17076) Avail: NTIS HC A08/MF A01 CSCL 08G

This issue of the Newsletter is essentially a catalog of all antarctic meteorites in the collections of the Johnson Space Center Curation Facility and the Smithsonian except for 288 pebbles now being classed. It includes listings of all previously distributed data sheets plus a number of new ones for 1979. Indexes of samples include meteorite name/number, classification, and weathering category. Separate indexes list type 3 and 4 chondrites, all irons, all achondrites, and all carbonaceous chondrites. GRA

N82-23841# California Univ., Riverside. Statewide Air Pollution Center.

EXPERIMENTAL PROTOCOL FOR DETERMINING ABSORPTION CROSS SECTIONS OF ORGANIC COMPOUNDS Interim Report

J. N. Pitts, Jr., A. M. Winer, D. R. Fitz, A. K. Knudsen, and R. Atkinson Sep. 1981 40 p refs
(Contract EPA-R-806661)
(PB82-121161; EPA-600/3-81-051) Avail: NTIS HC A03/MF A01 CSCL 04A

Utilization of this protocol will provide a basis for evaluating the possible relative importance of one atmospheric reaction pathway (i.e., photolysis) for organic substances which may be emitted into the environment. The experimental technique involves measuring the absorption spectrum over the wavelength region 285-825 nm at various known gas phase concentrations of the test compound in one atmosphere of ultra-pure air. From the measured absorbance (averaged over 10 nm wavelength regions) at the known concentrations of the test compound, absorption cross-sections (again averaged over 10 nm wavelength increments) can be calculated. These absorption cross-sections, together with solar flux data from the literature, then permit calculation of the photolysis rates under atmospheric conditions. GRA

N82-23842# Transport and Road Research Lab., Crowthorne (England). Tunnels and Underground Pipes Div.

REPRODUCIBILITY OF JOINT SPACING MEASUREMENTS IN ROCK

V. J. Ewan, G. West, and J. Temporal 1981 31 p refs
(PB82-135344; TRRL-LR-1013; ISSN-0305-1293) Avail: NTIS HC A03/MF A01 CSCL 08G

The reproducibility of measurement of joint spacing in rock was investigated. The rocks studied were sandstone, mudstone and limestone exposed in the Kielder Aqueduct Tunnels; the same limestone exposed in a nearby quarry was also studied. Joint spacing measurements made on site were also compared with measurements made from stereophotographs. It was found that for six observers measuring a 10m long scanline, the number of joints recorded can vary by up to a factor of nearly four without there being any real difference in the joint spacing of the rock. Measurements made from stereophotographs showed more joints than measurements made on site. When the joint spacing results were used to assign the rocks to recognized joint spacing classification categories, the results never varied by more than two adjacent categories, suggesting that the effects of the variation may not be so serious from the engineering classification standpoint. GRA

N82-23843# Washington State Univ., Pullman.

FOLDS AND FOLDING IN SINGLE-AND MULTI-LAYERED ROCKS: MATHEMATICAL MODELS AND FIELD OBSERVATIONS Ph.D. Thesis

James Iwan David Alexander 1981 158 p
Avail: Univ. Microfilms Order No. 8129953

The structural dynamics problem of the initiation of plane folding in horizontally layered rocks undergoing a layer parallel compression at a constant rate of strain is reexamined. A two dimensional mathematical model is employed which represents this situation in terms of a layered quasistatic heterogeneous Newtonian fluid, and includes the effects of gravity and surface tension. The critical conditions for the onset of folding are developed by performing the relevant linear stability analysis on the appropriate planar interface solution to the governing equations. The result of the stability analysis indicates that, owing to the stabilizing effects of gravity and surface tension, there is a critical threshold value of the imposed rate of strain below which no folding will occur. This model is used, with some success, to explain features associated with microfolds in the Castile Multilayer, New Mexico. Dissert. Abstr.

N82-23844# North Carolina State Univ. at Raleigh.

MINERALOGICAL TRANSFORMATIONS IN SOILS DERIVED FROM MAFIC ROCKS IN THE NORTH CAROLINA PIEDMONT Ph.D. Thesis

Thomas John Rice, Jr. 1981 235 p
Avail: Univ. Microfilms Order No. 8128548

The chemical, morphological, and mineralogical properties of two Enon sandy loam (fine, mixed, thermic Ultic Hapludalfs) soil-saprolite profiles in the North Carolina Piedmont were characterized. The mineralogical transformations from the primary minerals in the unaltered parent rocks to secondary minerals in the saprolite and overlying soil were determined. The parent rock from the Enon profile near Albemarle, Stanly County, North Carolina was a medium-grained metagabbro with chlorite, hornblende, quartz, and calcic plagioclase feldspar as the dominant primary minerals. Chlorite weathered to regularly interstratified chlorite-vermiculite and regularly interstratified chloritesmectite. The regularly interstratified chloride-smectite alters to smectite and randomly interstratified chlorite-smectite. Particle size decreases with each mineral alteration. Hornblende weathers to smectite and goethite. Calcic plagioclase feldspar transforms to kaolinite in the saprolite and soil horizons. Quartz is relatively resistant to chemical weathering. Dissert. Abstr.

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N82-23845# Oklahoma Univ., Norman.
AN APPLICATION OF STOCHASTIC FORECASTING TO MONTHLY AVERAGED 700 mB HEIGHTS Ph.D. Thesis
Albert Joseph Koscielny 1981 110 p
Avail: Univ. Microfilms Order No. 8129400

The statistical forecast method of multivariate autoregression was applied to a 27 year record of monthly averaged 700 mb heights. According to the theorem of predictive decomposition, a stationary series can be represented as the sum of deterministic and stochastic parts that are uncorrelated. Hence the deterministic annual cycle is removed and the statistical model applied to standardized anomalies of the 700 mb heights. One month dependent and independent forecasts of the standardized height anomalies were made and compared to similar forecasts made climatologically. The multivariate autoregressive model is found to perform better on the average than climatology. Several monthly forecasts were also made and examined for retrogression of anomalies. For the single case studied, the model is found to move features both eastward and westward. Dissert. Abstr.

N82-23846*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
METEOROLOGICAL AND CONSTITUENT DATA FOR JANUARY AND FEBRUARY 1981
1 Jul. 1981 128 p
(NASA-TM-84141; WFC-221-81-104; NAS 1.15:84141) Avail: NTIS HC A07/MF A01 CSCL 04B

Balloon data consisting of a plot showing the mixing ratio of ozone partial pressure in micromillibors and temperature in degrees centigrade versus pressure altitude in millibars is presented. An accompanying tabulation of meteorological and constituent data is also presented. The total overburden was aquired by Dobson Spectrophotometer 72. Author

N82-23847# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia).
TWO DIMENSIONAL HISTOGRAMS OF GMS-1 SATELLITE VISIBLE ALBEDO AND INFRARED TEMPERATURE FOR SELECTED CLOUD SYSTEMS
C. Martin R. Platt 1981 46 p refs
(Rept-40; ISBN-0-643-00420-3) Avail: NTIS HC A03/MF A01

Simultaneous GMS satellite data of infrared brightness temperature and visible (solar) albedo were assembled into a set of two dimensional histograms representing various fields of 'typical' clouds. These include boundary-layer stratocumulus, tradewind cumulus, continental cumulus, frontal cloud, jetstream cloud, cloud associated with tropical disturbances and cyclone cloud. The area covered in each case is approximately 500 x 500 sq km. The various histograms are accompanied, where possible, by GMS hard-copy grey-scale images of the region being studied and its surroundings. The various cloud types can be distinguished broadly by the shapes of the histograms. Author

N82-23848# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Physics.
AUSTRALIAN METEOROLOGICAL DATA SET FOR STUDIES OF PLUME RISE AND DISPERSION, PART 1
K. T. Spillane and J. Wren 1981 16 p refs
(Rept-39; ISBN-0-643-00419-X) Avail: NTIS HC A02/MF A01

Detailed aerological soundings of temperature, humidity and wind, averaged over layers of uniform density stratification, are presented for selected sites. The continuous records over the five-year period 1973-77 are arranged for use in studies of plume rise and dispersion. The assessment of the spatial and temporal variations of initially buoyant emissions to the atmosphere begins with calculations of plume rise and determinations of 'effective' height of a chimney. The effective location at this height depends on the plume location, its dimensions and the dispersion characteristics of the atmosphere. Thus, the effective height and location of a chimney both vary with atmospheric conditions. R.J.F.

N82-23849# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Physics.
AUSTRALIAN METEOROLOGICAL DATA SET FOR STUDIES OF PLUME RISE AND DISPERSION, PART 2
K. T. Spillane and J. Wren 1981 8 p refs
(Rept-41; ISBN-0-643-00427-0) Avail: NTIS HC A02/MF A01

Aerological soundings of temperature, humidity and wind, averaged over layers of uniform density stratification are detailed. A five year period, 1973-77, of continuous records is arranged for use in studies of plume rise and dispersion. In addition, a further three-year period, 1978-80, was included for Sydney (Mascot) bringing the total study period for that location to approximately four and a half years. R.J.F.

N82-23850# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
THE PRECIPITATION ENHANCEMENT PROJECT (PEP)
Dieter Paffrath Sep. 1979 88 p refs In GERMAN; ENGLISH summary Proc. of the Training Workshop on Weather Modification for Meteorologists, Valladolid, Spain, Mar. 1979 Translation was announced as N81-21716
(DFVLR-Mitt-79-12) Avail: NTIS HC A05/MF A01

Physics of clouds and precipitation, theories of weather modification, and aircraft measuring systems are presented. Application of weather radar, microphysical measurements, condensation and ice nuclei, cloud seeding technology, hail suppression and fog dispersal are discussed. S.L.

N82-23851# World Meteorological Organization, Geneva (Switzerland).
INTERNATIONAL CONFERENCE ON EARLY RESULTS ON FGGE AND LARGE-SCALE ASPECTS OF ITS MONSOON EXPERIMENT Global Atmosphere Research Programme
Apr. 1981 685 p refs Proceedings held at Tallahassee, Florida, 12-17 Jan. 1981; sponsored in cooperation with National Academy of Science, Florida State Univ. and Center for Professional and Public Service Prepared in cooperation with ICSU, Rome
Avail: NTIS MF A01; HC WMO

The FGGE investigations of planetary scale meteorology, monsoons, and oceanographic effects on climate are reported. The impact of FGGE data on forecasting is assessed. Radiative heat sources and numerical modeling of the summer monsoon are treated. Cloud, circulation, and convection during the winter monsoon are covered. Monsoon onset is analyzed. For individual titles, see N82-23852 through N82-23952.

N82-23852# Wisconsin Univ. - Madison.
THE IMPACT OF METEOROLOGICAL SATELLITES ON THE

FIRST GARP GLOBAL EXPERIMENT (FGGE)
Verner E. Suomi *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 7 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The impact of meteorological satellite observations is presented. Drifting buoys provide sea level atmospheric pressure and sea surface temperature for Tiros N temperature sounder retrievals. Geostationary satellites help to construct more accurate long range forecasting models. The Indian monsoon is observed. Author (ESA)

N82-23853# European Centre for Medium-Range Weather Forecasts, Reading (England).
THE IMPACT OF FGGE ON GLOBAL MEDIUM RANGE FORECASTS
Lennart Bengtsson *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 16 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Data acquisition for global forecasts is discussed in light of FGGE results. Numerical experiments were performed for three data sets: FGGE level 2b data, an automatic space oriented system, and the present operational global observing system. The space oriented system performs well and is almost equivalent to the FGGE system in the Southern Hemisphere. It has a more intense synoptic situation analysis than other systems in the Northern Hemisphere. The importance of high resolution comprehensive models for data assimilation is stressed. The present operational system has serious deficiencies and the deterioration of that system compared to the FGGE 2b system reduces the length of useful forecasts, particularly in the Tropics and Southern Hemisphere. Operational experience indicates the need for a mixed approach e.g., buoys, ASDAR (winds) and satellites (winds, temperature). Author (ESA)

N82-23854# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STATE OF THE ATMOSPHERE AS INFERRED FROM THE FGGE SATELLITE OBSERVING SYSTEMS DURING SOP-1
M. Halem, E. Kalnay-Rivas, W. E. Baker, and R. Atlas *In* WMO Intern. Conf on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 15 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO CSCL 04B

The statistical properties, and coverage, of satellite temperature sounding data are described. Tropical regions are observed every two days, extratropics from one to four times a day. Oceans are covered two to three times a day. Asynoptic coverage is comparable to the U.S. rawinsonde network twice daily coverage. Lack of ground truth for data sparse areas makes accuracy difficult to assess. The rms differences of layer mean temperatures obtained from collocating rawinsonde observations with satellite temperature profiles in space and time differ from rms differences of layer mean satellite temperature soundings. The FGGE satellite systems can infer the three dimensional motion field and improve the representation of the large scale state of the atmosphere. Author (ESA)

N82-23855# Tokyo Univ. (Japan). Inst. of Geophysics.
SUMMARY OF PRELIMINARY RESULTS ON FGGE AND MONEX IN JAPAN
Tsuyoshi Nitta *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 3 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The summer monsoon was investigated using visible and IR observation data about convective cloud activity gathered by the Geostationary Meteorological satellite and research ship data on the surface, upper air, planetary boundary layer, and radiation. Cloudiness periodicities of 40 and 15 days are suggested. The 40 day fluctuation is linked to the active break cycle of the Indian monsoon and shows marked northward movement of cloudiness. Geopotential height, temperature, and winds react similarly. Day to day variations in downward long wave radiation are small in spite of the variability of cloud amount, perhaps due to the large emissivity of the lower atmosphere with a high water vapor content. The Bowen ratio is 0.07. Oceanic heat transport through horizontal mixing is small. Temperature profile shows a characteristic variation in the lowest layer below 600 m, closely connected with precipitation. During rainy periods, for several hours the potential temperature of the lowest atmosphere falls by 1 to 2 K and a marked stable layer is formed at 200 to 300 m. Below that level the stratification is nearly neutral. After rainy periods the lower neutral layer grows up to 600 m as the temperature rises. The specific humidity and wind speed are almost uniform in the neutral layer and sharply decrease above. Author (ESA)

N82-23856# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Physics.
MEAN SEA-LEVEL PRESSURE IN THE SOUTHERN HEMISPHERE DURING THE FGGE PERIOD
W. L. Physick and G. B. Tucker *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Drifting buoy recordings of mean sea level pressure (MSLP) are assessed as a means for investigating climate. Data from FGGE buoys were compared to long term MSLP's computed from daily numerical analyses and MSLP's from nine weather stations. Pressures observed in high latitude oceans during FGGE are lower than average for every month. The maximum difference is 12 mb. The MSLP is significantly different from normal. Mean zonal winds at 500 mb are significantly stronger by up to 50%. Buoys are useful data sources, but because the data is anomalous, they should not be used as reference points. Author (ESA)

N82-23857# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.
FGGE FOUR-DIMENSIONAL ANALYSIS SYSTEM AT THE GEOPHYSICAL FLUID DYNAMICS LABORATORY
K. Miyakoda, L. Umscheid, T. Terpstra, J. Ploshay, J. Sirutis, W. Bourke, C. T. Jobson, W. Stern, and W. Davis *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 9 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A four dimensional (preprocessing of input data, dynamical assimilation, static analysis, initialization) analysis system which assimilates observed data into the dynamical and physical processes of models is described. The spectral model of rhomboidal truncation of 30 zonal wavenumbers and 18 sigma levels with delta E2 normal intensity diffusion for divergence and vorticity and 100% humidity is the base. Time step is 15 min, determined by winter wind intensity at the top level of the model. The sequential (on-line) dynamic-static analysis system is employed. The interval between two consecutive static analysis is 12 hrs. The static analysis is based on the three dimensional univariate optimum interpolation method with the effect of observation error included. This analysis is applied at the sigma surface based on the dynamical assimilation field as the initial guess. The data are continuously injected with an appropriate weight depending upon the probable error of the insertion data. Author (ESA)

N82-23858# National Center for Atmospheric Research, Boulder, Colo.
THE TROPICAL OBSERVING SYSTEMS IN FGGE: AN ANALYSIS OF RESULTS
Paul R. Julian *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The FGGE combined observing and analysis system is assessed. Data from a day when all subsystems (buoys, dropwindsondes, platforms, balloons, aircraft, satellites) operated are presented nonquantitatively. Major dynamic features associated with convective processes, e.g., wind fields, cloud motion, are well observed, providing important data for numerical weather forecasting. However, strong convergence/divergence fields on scales below 8 deg are poorly covered. The National Weather Program models cannot cope with the dynamics of the convective

tropical atmosphere, even using sophisticated initialization and convective parameterization schemes. Author (ESA)

N82-23859# Meteorological Satellite Center, Tokyo (Japan).
ESTIMATING TOTAL PRECIPITABLE WATER (TPW) DISTRIBUTION FROM THE INFRARED DATA (10.5 - 12.5 MICRONS) OF THE GEOSTATIONARY METEOROLOGICAL SATELLITE (GMS)
Tadao Aoki, Masato Murakami (Meteorological Research Inst., Ibaraki, Japan), and Toshiro Inoue (Meteorological Research Inst., Ibaraki, Japan) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A method for determining TPW over tropical oceans is presented. The GMS collected IR radiance data in the atmospheric window region from 10.5 to 12.5 microns. Radiance observed by the satellite varies with changes in atmospheric water vapor content since the water vapor absorbs radiation from the sea. Satellite predictions were tested using radiosonde data. A 0.53 g/cu cm difference results. This is because the observations were 100 km apart and the radiosonde total includes water vapor measured when it passed through cloud. The satellite measures clear air only. In spite of this discrepancy the daily TPW variations agree well. Over data sparse areas, e.g., a low latitude ocean, the method provides reliable estimates.
Author (ESA)

N82-23860# Wisconsin Univ., Madison. Space Science and Engineering Center.
INTERCOMPARISON OF FGGE CLOUD TRACKED WINDS
Frederick R. Mosher *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Cloud tracked winds obtained from Meteosat, GOES, and the Geostationary Meteorological Satellite by national meteorological institutes are compared. Although tracking techniques were not standardized, cloud wind data sets are compatable. Comparison of cloud wind data differences between collocated vectors shows similar difference characteristics for all the data producers. Systematic biases between data producers for any given analysis period are small. Biases due to image alignment are <2 m sE-1 for most producers. This is due to the manual alignment of the images for the NESS movie loop and the coarse resolution of the GOES infrared sensor. Wind height assignment procedure differences among the data producers cause systematic height variations of up to 100 mb, with the Japanese data sets being consistently higher than other producers. Author (ESA)

N82-23861# National Meteorological Center, Washington, D.C.
THE UNITED STATES' SPECIAL EFFORT: RESULTS OF DATA EDITING FOR THE FIRST SPECIAL OBSERVING PERIOD
G. DiMego, C. McCalla, M. McCalla, J. Badner, D. Mannarano, and H. Carney *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p ref (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Processing of FGGE level 2 data from satellite ocean sounding and cloud track wind data is described. Operational satellite soundings and cloud track winds are edited. Areas are selected, and enhanced satellite soundings are generated. Except for orbit sections in the eastern North Pacific which are routinely enhanced, the areas selected vary from day to day and are chosen from a set of nominated cases. The enhanced soundings are edited and operational soundings in the same areas are reviewed. The edited and enhanced data are put into the international 2b format and distributed to the 3b analysis center. Editing is subjective, based on synoptic reasonableness, internal consistency (horizontal, vertical, temporal), consistency with data of different types, consistency with imagery, and consistency with the analyses. Clear column retrievals show best results, followed by partly cloudy ones. Microwave retrievals are poor due to liquid water contamination and disagreement with neighboring retrievals of different types. Author (ESA)

N82-23862# Main Geophysical Observatory, Leningrad (USSR).
COMPREHENSIVE AEROSOL-RADIATION OBSERVATIONS IN THE FREE ATMOSPHERE DURING THE FIRST AND SECOND GLOBAL METEOROLOGICAL EXPERIMENT SPECIAL OBSERVATION PERIODS
K. Y. Kondratyev, V. I. Binenko, V. F. Zhvalev, V. A. Ivanov, M. A. Prokofyev, and N. E. Ter-Markaryants *In* WMO Intern. Conf. On Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 2 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The impact of desert aerosols on atmospheric radiation under extreme winter conditions is discussed. Direct filter sampling, photoelectric techniques, and lidar were used to determine atmospheric aerosol parameters. Aerosol radiation data were collected for stable clear weather with low wind speeds, dust storms, and highly turbid atmosphere. The highest radiative flux convergence is in the lower 500 m layer in clear conditions. Both shortwave and longwave fluxes input to atmospheric heating. The transfer to general radiative cooling occurs above 3 km. During dust storms the general radiative cooling is observed in the atmospheric boundary layer up to 1.7 km due to strong cooling by longwave exchange which overrules the shortwave heating. Over ice the stratiform cloudiness albedo is higher than other water by 0.06 to 0.12. Author (ESA)

N82-23863# National Center for Atmospheric Research, Boulder, Colo.
CHARACTERISTICS OF ATMOSPHERIC PLANETARY CIRCULATIONS AND ASSOCIATED MODEL FORECAST SKILL DURING FGGE CASE STUDIES BY THE WORKING GROUP ON NUMERICAL EXPERIMENTATION
David P. Baumhefner and Thomas W. Bettge *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The general characteristics of the planetary circulation are described. The behavior of these features is then related to the 72 hr forecast skill of the operational model. A separation of the observed structure into low frequency/stationary components (30 to 90 day means) and the residual transients is examined. The partitioning of the forecast error into these stationary and transient parts is evaluated. The analysis of an example of the transient nature of the planetary circulation and the difficulty of forecasting such a transition is presented. Model performance is closely linked to planetary structure, e.g., rapid transitions in planetary waves reduce accuracy. The cases selected allow blocking, planetary wave dynamics, cyclogenesis, and wave interactions to be studied. Author (ESA)

N82-23864# Princeton Univ., N. J. Geophysical Fluid Dynamics Lab.
VARIOUS FOUR-DIMENSIONAL ANALYSIS METHODS
K. Miyakoda, J. Ploshay, W. Stern, and K. Puri (Australian Numerical Methodology Research Centre) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Four dimensional static/dynamical analysis systems for weather map analysis were tested, viz: scheme alpha (as used in operational centers); scheme beta (analyses are taken from the global three dimensional univariate optimum interpolation analysis (OPI) based on the initial dynamical assimilation guess); scheme sigma (linear normal mode adjustment is applied every time step immediately after data injection); and scheme gamma (dynamical assimilation and OPI are in sequence). Geopotential height maps are very similar for all schemes. Scheme alpha gave the largest intensity of wind, the deepest trough, and the largest eddy kinetic energy. Scheme gamma is second. However, the differences are not large. The meridional component of wind in the equatorial region is strongest in scheme alpha, next strongest in scheme gamma. Scheme gamma provides smooth moisture analysis compared with other schemes. Author (ESA)

N82-23865# Australian Numerical Meteorology Research Center, Melbourne.

A LIMITED AREA OBJECTIVE ANALYSIS/PROGNOSIS EXPERIMENT USING FGGE DATA IN THE AUSTRALIAN REGION

G. A. Mills *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 7 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A meteorological acquisition system for the oceanic areas south and west of Australia is described. Land based synoptic assessments, drifting buoys mean sea level pressure observations, radiosonde and Tiros N sounding data augment the existing network. Predictions were compared to those produced operationally by numerical forecasting and a nine day sequence of analyses was prepared, first with no externally prescribed boundary conditions then sequence time dependent boundary conditions were provided from a parallel hemispheric assimilation experiment. The system performs well. The addition of updated boundary conditions to the 6 hr prognosis phase of the analysis/prognosis cycle leads to small but significant improvements in the quality of analyses. Author (ESA)

N82-23866*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Goddard Lab. for Atmospheric Sciences.

LARGE AMPLITUDE STATIONARY ROSSBY WAVES IN THE SOUTHERN HEMISPHERE

Eugenia Kalnay and Milton Halem *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. May 1981 11 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Large Amplitude stationary waves downstream of South America, and in the lee of Australia were investigated using Tiros N photographs. These waves appear to be Rossby lee waves associated with anomalous poleward flow over the Andes and by continental heating over Australia. The waves have a maximum amplitude near 300 mb between 20 and 40 deg S and correlate well with observed precipitation bands in the Atlantic and Pacific Oceans. The orientation of these waves is such that they transfer zonal momentum to the roaring forties latitudes. Stationary Rossby waves, in the Northern Hemisphere, have a characteristic wavelength of the order of 120 deg longitude. In January the observed stationary wavelengths have a wavelength of less than 60 deg longitude with an amplitude in the upper tropospheric meridional wind of more than 15 m sec E-1.
Author (ESA)

N82-23867# Wisconsin Univ., Madison. Space Science and Engineering Center.

SEASONAL CIRCULATIONS OVER THE INDIAN OCEAN DURING FGGE FROM GEOSTATIONARY SATELLITE DATA

Hassan Virji *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-21873)
Avail: NTIS MF A01; HC WMO

The evolution of tropospheric circulation over the Indian Ocean was investigated. The GOES satellite observed the circulation over this region during one complete annual cycle. Cloud tracking using GOES imagery provided synoptic wind coverage for the tropospheric flow in two layers. Analysed windfields for the upper (300 to 100 mb) and lower (1000 to 700 mb) layers are derived from the cloud motion vector data. Daily cloud motion vector data were interpolated onto 2 deg x 2 deg grids. The grids are used to obtain the monthly average flow fields and space time cross sections of the flow regime. Analysis shows that the westerly monsoonal jet occurs one week before the onset of the monsoon. Author (ESA)

N82-23868# Maryland Univ., College Park.

ATMOSPHERIC NORMAL MODES AS SEEN IN FGGE DATA

F. Baer *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-17429)
Avail: NTIS MF A01; HC WMO

Normal mode functions, used in adjusting observations to the initial condition requirements of prediction models, are compared with observational modes. Using FGGE level 3a analysis for special observing period 1 (SOP1), and by applying covariance techniques, the characteristic vertical structure in each planetary wave (averaged over all latitudes in the Northern Hemisphere) is described for the temperature and stream fields. For each planetary wave and vertical structure the characteristic latitudinal structure is computed in order to gain insight into the primary atmospheric characteristic structures. Comparing FGGE SOP 1 atmospheric flow with the 1973 flow for the same season illustrates that the longer waves for these data sets (i.e., 1973 vs 1979) possess different characteristic structures while the shorter waves have similar characteristics. Applications of normal mode analysis include determining the necessary observation resolution associated with meteorological observing systems or the efficient compacting of meteorological data sets. Author (ESA)

N82-23869# Wisconsin Univ., Madison.

THE GLOBAL STRUCTURE OF ENERGY TRANSPORT WITHIN THERMALLY-FORCED PLANETARY SCALE MASS CIRCULATIONS

D. R. Johnson, R. D. Townsend, M. Y. Wei, and R. D. Selin *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
(Grants NSF ATM-77-22976; NSF ATM-78-22384)
Avail: NTIS MF A01; HC WMO

Zonally averaged diabatic heating was determined then correlated with the vertically integrated energy transport within the atmosphere. Using isentropic diagnostic techniques, the components of the horizontal energy transport (rotational and irrotational) were determined. Results show that in isentropic coordinates the horizontal energy transport can be determined by the time-averaged mass circulation. The net energy transport from a source region to a sink region occurs when more energy is transported by a branch of the circulation in higher valued isentropic layers than the return flow in lower-valued isentropic layers. Analysis of planetary energy transport suggests that the primary source regions of energy are Indonesia, the Philippines and South East Asia while energy sinks occur in higher latitudes, the Sahara and the eastern portion of subtropical highs. These sources and sinks were found to vary in intensity and position with the seasons. Author (ESA)

N82-23870# Wisconsin Univ., Madison.

THE STRUCTURE OF THE PLANETARY SCALE DIABATIC PROCESSES FOR THE ATMOSPHERE DURING FGGE

M. Y. Wei, D. R. Johnson, and R. D. Townsend *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-22384)
Avail: NTIS MF A01; HC WMO

Planetary scale (10,000 km) diabatic processes were investigated using level FGGE 3a data for January and July 1979. Through the mass continuity equation (in isentropic coordinates) the diabatic vertical mass transport and heating rates are estimated. The regions of net upward diabatic mass transport during January include: New Guinea South America, Africa and the oceanic regions east of North America and Asia. For July the upward mass transport was over Central America, the Asiatic monsoon region, South Australia, west of South America and south of Africa. At the planetary scale regions, the heating and cooling agree with past climatological concepts. Heating persists in the northern midlatitude zone throughout the year.
Author (ESA)

N82-23871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ROLE OF ZONALLY ASYMMETRIC HEATING IN THE VERTICAL AND TEMPORAL STRUCTURE OF THE GLOBAL SCALE FLOW FIELDS DURING FGGE SOP-1

J. Paegle (Utah Univ.), E. Kalnay-Rivas, and W. E. Baker *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 9 p refs Sponsored in part by National Research Center (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO CSCL 04B

By examining the vertical structure of the low order spherical harmonics of the divergence and vorticity fields, the relative contribution of tropical and monsoonal circulations upon the global wind fields was estimated. This indicates that the overall flow over North America and the Pacific between January and February is quite distinct both in the lower and upper troposphere. In these longitudes there is a stronger tropical overturning and subtropical jet stream in January than February. The divergent flow reversed between 850 and 200 mb. Poleward rotational flow at upper levels is associated with an equatorward rotational flow at low levels. This suggests that the monsoon and other tropical circulations project more amplitude upon low order (global scale) representations of the flow than do the typical midlatitude circulations and that their structures show conspicuous changes on a time scale of a week or less. Author (ESA)

N82-23872# Hawaii Univ., Honolulu.

OROGRAPHIC INFLUENCE OF THE TIBETAN PLATEAU ON THE ASIATIC WINTER MONSOON CIRCULATION

Takio Murakami *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)

(Grant NSF ATM-79-07255)

Avail: NTIS MF A01; HC WMO

The orographic influence of the Tibetan Plateau on the development, propagation and dissipation of upper level troughs was examined. Twice-daily 2.5 deg latitude-longitude resolution data at levels from 100 to 1000 mb were collected. Surface pressures and winds were estimated over a smoothed topography. Results show 15 to 20 day period oscillations in wind fields. Phase speeds and intensities of 200 mb velocity potential fields associated with the eastward passage of the 12 to 20 day perturbations are significantly influenced by the orography of the Plateau. Nonlinear wave-wave interactions explain the presence of the oscillations. Author (ESA)

N82-23873# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.

PLANETARY-SCALE MOTIONS OF WINTER MONSOONS DURING COLD SURGE AND BREAK PERIODS

C.-P. Chang and K. M. Lau *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)

(Grant NSF ATM-79-24010)

Avail: NTIS MF A01; HC WMO

A four-winter data set was used to study oscillations in the large scale motion of a winter monsoon. Eight strong surge cases and five well defined break cases are composited in order to isolate the coherent changes in these oscillations. Analysis of time series composites for the surges shows that the East Asia jet stream and tropical convective activity intensify steadily for 5 days from the start of a surge, whereas the West Asian jet stream weakens for 4 days. The upper level return flow of the local Hadley circulation increases steadily, but with a time lag of 2 days. Analysis of break cases suggests a different circulation regime, especially in midlatitude. Because during surges the changes in the equatorial parameters are correlated with the midlatitude events, the lack of coherent oscillations in these parameters during monsoon breaks suggests that the tropics are forced by the midlatitude rather than vice versa.

Author (ESA)

N82-23874# Commonwealth Scientific and Industrial Research Organization, Mordialoc (Australia). Div. of Atmospheric Sciences.

MECHANISMS DETERMINING THE MEAN AND TRANSIENT STRUCTURE OF THE LARGE-SCALE WINTER MONSOON; COLD SURGES

Peter J. Webster *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 10 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

Cold surges identified in the Hong Kong region were compared with those in Australia to see if they resulted from similar processes. The open level accelerating jet stream, the migration trough, and surface pressure anomalies were examined. The development of a surge is described, confirming the fact that the mechanisms which account for surges in the Northern Hemisphere (wind, surface pressure, as well as temperature) are the same for the Southern Hemisphere; the cold Siberian High is not the determining factor. Author (ESA)

N82-23875# Malayan Meteorological Service, Kuala-Lumpur.

MIDDLE LATITUDE INTERACTIONS DURING THE WINTER MONSOON

Boon Khean Cheang and T. N. Krishnamurti (Florida State Univ.) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

The excitation of tropical waves was studied using Northern Hemisphere weather maps for winter for an 11 year period. Downstream amplification over midlatitudes at 500 mb, and amplification and wave propagation in low latitudes were considered. Time dependent composite diagrams of rainfall and atmospheric pressure were drawn. Zonal harmonics around the latitude circle at 5 deg N were used for spectral analysis. During wet spells a tropical lower tropospheric westward propagating downstream amplification is excited by an eastward propagating upper tropospheric downstream amplification over the middle latitudes. The interaction occurs via an upper trough development at 500 mb over the central Pacific. If the positions of the developing upper troughs occur over the Central Bay of Bengal, off the Asian coast around 140 deg E, or over the central Pacific around 160 deg W, then the upper Westerlies are pushed very far south and a dry spell prevails. Author (ESA)

N82-23876# Hawaii Univ., Honolulu.

CHANGES IN STREAMFUNCTION AND VELOCITY POTENTIAL FIELDS DURING THE 1978 - 1979 WINTER

Akimasa Sumi and Takio Murakami *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)

(Grant NSF ATM-79-07255)

Avail: NTIS MF A01; HC WMO

The objective analysis scheme used to process data from the First Global Atmospheric Research Program Global Experiment/Winter Monsoon Experiment is described. The scheme is an extension of the correction method, and incorporates concepts of the optimum interpolation theory. Examples of winter mean circulations at 200 and 850 mb, and long-period disturbances at 850 mb are summarized. Strong convective activity is described in the eastern end of the Southern Hemisphere trough. Anomalous southerlies, anomalous northerlies, and surge patterns are described for the areas investigated. Author (ESA)

N82-23877# Missouri Univ. -Columbia. Dept. of Atmospheric Science.

ENERGETICS OF THE ASIAN WINTER MONSOON AND COLD AIR OUTBREAKS

Ernest C. Kung, Paul H. Chan, and Stephen E. Masters *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)

(Grant NSF ATM-77-24558)

Avail: NTIS MF A01; HC WMO

Characteristic portions of winter monsoon circulation were studied using standard aerological observations. The energy variables involved in the kinetic energy balance of these six regions were computed from the twice-daily upper air data during a two-winter period. This Siberia High, the energetics of Northeastern Asia, the strong westerlies over the China Main, East China Main, East China Sea, Japan Sea, and North America were considered. The level of kinetic energy and intensity of energy transformations in these regions were examined. Dissipation associated with cyclones was also studied. It was found that the kinetic energy generated in the winter monsoon derives from the source within the monsoon in the upper and mid troposphere. Cold air outbreaks do not change the energetics of the system. Author (ESA)

N82-23878# Wisconsin Univ., Madison.

LOW-LEVEL SUMMER MONSOON CIRCULATIONS

John A. Young *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
(Contract NOAA-7-35217; Grants NSF ATM-78-21873; NSF ATM-78-25503)
Avail: NTIS MF A01; HC WMO

Wind fields obtained from the Indian Ocean geostationary satellite were used to quantitatively estimate the kinematic and dynamic properties of the 900 mb summer monsoonal flow during Monex. Mean flow results are consistent with expectations, including: (1) divergence/convergence over the Arabian Sea; (2) a region of possible inertial instability to the north of the equator over the Arabian Sea; (3) nonconservation of absolute vorticity; (4) a pressure field with small but important equatorial gradients; (5) lack of quasigeostrophic conditions within about 10 deg of the equator. Wind transients were examined from daily, 5 day and monthly mean maps and space-time (Hovmuller type) diagrams. While some synoptic systems can be tracked, the dynamical link of winds across the equator is generally not obvious. Author (ESA)

N82-23879# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
REPRESENTATIVENESS OF CLOUD MOTION WINDS DEDUCED FROM GOES INDIAN OCEAN SATELLITE IMAGERY FOR THE DESCRIPTION OF THE INDIAN SUMMER MONSOON
Michel Desbois *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A technique which extracts wind fields from cloud motions is described and data thus produced are compared with cloud winds extracted by standard methods, dropsondes and balloon winds of the BALSAMINE experiment. A set of successive pictures is presented in loops. Each picture can be moved relative to the others. Pictures are aligned using landmarks and cloud motions are measured by moving the pictures so that the observed cloud appears motionless during the loop. The relative displacement of the pictures and the location of the cloud elements are recorded and the results are processed on a computer that plots them on a map. It takes 4 hr to obtain a field. Results compare well with other methods and indicate that low cloud tracers follow the wind like constant level balloons. Over the Indian Ocean low cloud winds are representative of the 900-850 mb layer. Cloud winds are advocated as a tool for investigating monsoons. Author (ESA)

N82-23880# Florida State Univ., Tallahassee. Dept. of Meteorology.
INTERACTION BETWEEN THE SOUTHERN HEMISPHERE AND THE MONSOON CIRCULATION
Daniel Cadet *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The 850 mb field over the Indian Ocean was analyzed using x-t diagrams (x = jet stream axis, t = time) in order to understand the interaction between the meteorological systems at the midlatitudes of the Southern Hemisphere and the monsoon circulation. The Southern Hemisphere systems influence the tradewinds in the southern Indian Ocean. The interaction gives rise to strong winds which extend nearly simultaneously over the ocean up to about 10 deg S. In the spectral range around 7 days there is an upstream propagation of perturbations along the jet axis down to 15 deg S which are not related to the meteorological systems of the Southern Hemisphere. In the spectral range around 12 days there is a downstream propagation of perturbation along the jet which can be traced from 15 deg S up to India. One of these perturbations is limited to the onset of the monsoon over the central Arabian Sea. Author (ESA)

N82-23881# Indian Meteorological Dept., New Delhi.
INTERACTIONS BETWEEN NORTHERN MIDDLE LATITUDES AND SUMMER MONSOON CIRCULATION
H. S. Bedi, H. S. Billa, and N. Mookerjee *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Meridional exchanges of momentum and heat across the northern boundary of a monsoon region are discussed for a good and a poor monsoon. Geopotential height, temperature, and wind fields at 500 and 300 mb were used to calculate time averages of momentum transport, and eddy transports (heat, momentum). Temperature does not vary significantly between the two monsoons, all other parameters do, especially zonal winds and eddy momentum transport. Strong westerlies produce a good monsoon. The migrating westerly systems of the midlatitudes are more active during a weak monsoon. The mean meridional circulation over the northern parts is stronger during a good monsoon. Author (ESA)

N82-23882# Jawaharlal Nehru Univ., Poona (India).
INTERACTION OF WAVES IN MIDDLE LATITUDE WESTERLIES OVER ASIA WITH THE SOUTHWEST MONSOON OVER INDIA
C. R. V. Raman and Y. P. Rao *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Prediction of intense monsoon activity and drought is discussed. Severe summer droughts in India accompany prolonged breaks in the southwest monsoon circulation. Pressure data from the years of severe drought suggest that the breaks are due to upper tropospheric blocking ridges over East Asia. A model for the evolution of two such blocking ridges is presented: the East Asia (EABR) and the West Asia (WABR). An intense WABR - the initiator of the monsoon break precedes the formation of the EABR. Although a more precise classification of the morphology and pattern of movement of midlatitude troughs and ridges is required, this cycle is a promising forecasting technique. Author (ESA)

N82-23883# Florida State Univ., Tallahassee. Dept. of Meteorology.
ON THE ONSET OF THE PLANETARY SCALE MONSOON
Richard J. Pasch IN WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The time evolution of ultralong, planetary scales was probed using the energetics of the sum of the three largest scales of eddies (zonal wavenumbers 1, 2 and 3). A planetary scale manifestation of the regional monsoon onset was found, i.e., a sudden increase in kinetic and available potential energy. The mechanisms responsible for this increase are: the generation of available potential energy on planetary scale by diabatic heating; the transfer of available potential energy to kinetic energy; and the nonlinear wave-wave and wave-zonal exchanges of available potential energy feeding into the ultralong waves. Author (ESA)

N82-23884# Physical Research Lab., Ahmedabad (India).
THE ASIATIC SUMMER MONSOON: A NEW THEORY
P. R. Pisharoty *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A literature review was used to challenge the traditional explanation of the Asian summer monsoon. An alternative is proposed in which the monsoon is considered to be a delayed compensatory response of the ocean-atmosphere system of the Northern Hemisphere to an insufficient global poleward transport of energy across the latitudinal belt of 30 deg N to 40 deg N during the preceeding winter. An active monsoon develops over Southeast Asia whenever the poleward transport of heat in the Northern Hemisphere during winter and spring is below normal. When that transport is above normal, there is no need for a good monsoon to develop, so it gets suppressed. The Tibetan High does not develop to its normal intensity; the advance of the thermal equator over the Arabian Sea and the Bay of Bengal during April and May lags behind the apparent northward movement of the Sun. Author (ESA)

N82-23885# State Hydrological Inst. (USSR).
RELATION OF THE VARIATIONS OF VERTICAL STRUCTURE OF THE EQUATORIAL ATMOSPHERE AND FLUCTUATIONS OF PLANETARY CIRCULATION WITH MONSOONS
B. S. Chuchkakov *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The quasibiennial and 6 month cyclicity of circulation in the equatorial stratosphere and mesosphere were investigated to establish their connection with monsoon rainfall. Data were collected by rocket sounding and ships for atmospheric circulation, pressure, and rainfall. Monsoon onset is dependent on air transport in the equatorial stratosphere in the western and eastern phases of the cycle. Positive directions mean earlier onsets. During the descent of the lower boundary of the western and eastern winds, onset anomalies correspond to definite equal, but different in sign, values of the transport. The different correlation between the phase of the cycle and the 3 or 4 month periodicity of atmospheric circulation are reflected. Based on these observations a one week delay is predicted for the 1981 Indian monsoon, with rainfall 40% above normal in Bombay in June. Author (ESA)

N82-23886# Indian Inst. of Tropical Meteorology, Poona.
CONTRASTING FEATURES OF THE LARGE-SCALE DYNAMICS OF TROPOSPHERIC CIRCULATION IN WAVE NUMBER DOMAIN IN RELATION TO THE PERFORMANCE OF MONSOON RAINS OVER INDIA WITH SPECIAL REFERENCE TO MONSOON EXPERIMENTS
S. T. Awade, M. Y. Totagi, and D. R. Sikka *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The contrasts in the circulation pattern, momentum, sensible heat and energetics in years of good and bad monsoon activity were compared using monthly mean Northern Hemispheric geopotential height data at 700 and 300 mb. The flux of angular momentum across a latitude circle by standing eddies is calculated by quasigeostrophic approximation. It is found that wave amplitude enhancement from the premonsoon to monsoon months is larger in good than in bad monsoon years. Northward transport of momentum at 30 deg N is larger in good than in bad monsoon years in premonsoon and monsoon months; sensible heat is larger in bad monsoon than in good monsoon years; and sensible heat flux divergence in the region between 20 deg N to 30 deg N is larger in bad than in good monsoon years. Author (ESA)

N82-23887# Missouri Univ. -Columbia. Dept. of Atmospheric Science.
LONG-RANGE MULTI-REGRESSION FORECASTING OF THE INDIAN SUMMER MONSOON ONSET AND RAINFALL WITH ANTECEDANT UPPER AIR PATTERN AND SEA SURFACE TEMPERATURE
Ernest C. Kung and Taher A. Sharif *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-77-24558)
Avail: NTIS MF A01; HC WMO

Forecasting monsoon onset by linear prediction is discussed. Five mean upper air parameters over the forecast area are used as predictors: April 100 mb geopotential height; 700 mb kinetic energy over India; an Indian Ocean surface temperature; January 700 mb u and March 700 mb T over Australia. A spring snowfall parameter does not produce the same effect as the Indian Ocean surface temperature and Australian upper air parameters. The use of precipitation records in place of snowfall records is questionable. The effect of snowfall may already be implicitly represented by the high level upper air parameters over northern India. Author (ESA)

N82-23888# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
RADIATIVE COMPONENTS OF SAUDI ARABIAN PENINSULA HEAT LOW
Stephen K. Cox and Steven A. Ackerman *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The radiative energy budget of the atmosphere and surface over the Saudi Arabian Peninsula is discussed and the effect of dust was examined. Surface sensible and latent heat fluxes are deduced as a residual in the balanced surface energy budget equation. Aircraft measurements are compared to calculations of short wave and long wave irradiance from vertical temperature and humidity soundings. Calculated and observed irradiances show agreement in dust free conditions. Dust doubles short wave absorption of an aerosol free atmosphere and dust has undetectable effects on long wave radiative fluxes of an aerosol free atmosphere. Due to the presence of the dust, the 570 to 850 mb layer shows a 24 hr average radiative warming while the boundary layer radiative divergence is suppressed. The 24 hr average surface budget components are: total radiative flux = 75 Wm E-2; ground storage = 3 Wm E-2; and sensible plus latent heat flux = 72 Wm E-2. Author (ESA)

N82-23889# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
HEAT LOW OVER SAUDI ARABIA
D. Blake, J. S. Fein (NSF, Washington D.C.), T. N. Krishnamurti (Florida State Univ., Tallahassee), and S. Low-Nam (Florida State Univ., Tallahassee) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The structure of the heat low over Saudi Arabia prior to the onset of the summer monsoon in India was investigated using soundings and flight level measurements made during day and night flights over the empty quarter. It is found that the ascending motion is surprisingly shallow, reaching only to 800 to 850 mb during the day, while at levels above 800 mb there is subsidence. At night there is subsidence all the way down to the ground. The change of vertical motion in the low layers occurs rapidly during the morning. The potential temperature is nearly constant at levels below 650 mb, indicating convective mixing from the ground to this level. Radiative cooling, however, does not balance the adiabatic heating by subsidence, leaving a net heating of 1 to 2K per day, possibly related to dust.
Author (ESA)

N82-23890# National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.
RADIATION BUDGET CHARACTERISTICS OF THE ONSET OF THE SUMMER MONSOON
W. L. Smith, L. D. Herman, T. Schreiner (Wisconsin Univ., Madison), H. B. Howell, and P. Menzel (Wisconsin Univ., Madison) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 11 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-80-14892)
Avail: NTIS MF A01; HC WMO

Satellite radiance measurements during the Monsoon Experiment (MONEX) are compared with normal years. Visible and infrared measurements from the GOES satellite over the Indian Ocean during the summer MONEX were calibrated for spectrally integrated short wave and long wave fluxes leaving the Earth atmosphere system. Temporal and spatial details of the radiation on budget properties observed during the onset stage of the 1979 Indian Monsoon are presented. Albedos in cloud free areas of Saudi Arabia, India, and the Arabian Sea are 40%, 20% and 10% respectively. The differences in the net radiation of the Earth atmosphere system between 1979 and normal monsoon years are due to larger convective cloud coverage during normal years. The interior of Saudi Arabia remains a radiative heat sink. The heating effect of cirrus clouds which trap the outgoing long wave radiation is indicated over the Arabian Sea. Author (ESA) the

N82-23891# National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.
COMPARISON OF SATELLITE DERIVED RADIATION BUDGET MEASUREMENTS OVER MONEX DURING 1979 TO 1980

P. Krishna Rao IN WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 7 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Earth atmosphere radiation budgets derived from polar orbiting satellite radiometers are compared for May to August 1979 and 1980. The data are the differences in outgoing fluxes and albedos between 1980 and 1979. The low values in outgoing longwave radiation are associated with high and thick clouds which are relatively cold. High albedo values over this region are associated with clouds and snow over the mountains; moderately high values are observed over Saudi Arabia.
Author (ESA)

N82-23892# State Hydrological Inst. (USSR).
HEAT RADIATION IN MONSOONS
N. A. Zaitseva and N. V. Hromova *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 3 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Radiative factors in monsoons were investigated by radiometer soundings of vertical profiles of long wave radiation and radiative inflows. The fluctuations of radiative cooling in different atmospheric layers are caused by cloudiness. Over the continent, variations of upper tropospheric cooling are contrary to lower tropospheric variations in the presence of low and medium clouds, when clouds warm the lower troposphere but simultaneously reinforce the cooling of upper layers. When heavy cloud clusters with high tops are in the troposphere. The cooling of the whole troposphere is decreased and the heating of the upper troposphere is even greater than that of the lower.
Author (ESA)

N82-23893# Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
MEASUREMENTS OF AEROSOL RADIATIVE PROPERTIES DURING MONEX: IMPLICATIONS OF THE MEASUREMENTS FOR RADIATIVE HEATING RATES
E. M. Patterson and G. W. Grans *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The optical properties of the aerosols that make up the layers, aerosol size and concentration and their vertical distributions were studied over Saudi Arabia to assess the effect of haze layers on eliminate. Absorption decreases from 0.01 at 300 nm to 0.004 at 700 nm. Above the haze layer, absorption factor is five times higher throughout the visible spectrum. Observed wavelength dependence is not characteristic of carbon. Haze layers have a well defined cap. Highest concentrations are near the surface. Each layer is a mixture of haze generators, whose sources are not under the measurement location. The predominant aerosol is similar to the crustal Saharan aerosol. Average heating rates due to the aerosol = 1K/day throughout the lower 6 km of the atmosphere over central Saudi Arabia.
Author (ESA)

N82-23894# Meteorological Dept., New Delhi (India).
THE ROLE OF TOPOGRAPHY AND HEAT SOURCES ON THE SUMMER MONSOON
P. K. Das and H. S. Bedi *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The thermal and mechanical effects of the Tibetan Plateau on the summer monsoon circulation was investigated by a 3 level, regional, primative equation model. The monsoon trough may not be caused by the mechanical effect of the Plateau, as it can be reproduced by diabatic heat sources. A controlled experiment (insertion of tropospheric heating profiles into the model) was performed to determine the impact of dust particles on monsoon circulation. The intensity of the monsoon trough is closely linked with fluctuations in tropospheric heat sources over Saudi Arabia.
Author (ESA)

N82-23895# National Center for Atmospheric Research, Boulder, Colo.
COUPLED AND UNCOUPLED ATMOSPHERE-OCEAN GENERAL CIRCULATION MODEL EXPERIMENTS ON SUMMER AND WINTER MONSOON
Warren M. Washington and Gerald A. Meehl *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs Sponsored by NSF (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The use of coupled atmosphere and ocean models in monsoon simulation is discussed. To clarify the role of atmospheric and ocean forcing, an uncoupled (driven by observed atmospheric forcing) ocean model experiment was performed. Wind stress computed by the model is compared with observed data. Simulation is good, in spite of a coarse horizontal grid size and the use of a fixed 50 m ocean mixed layer. Coupled models can simulate regional and global features of interactive ocean atmosphere climate regimes.
Author (ESA)

N82-23896# Florida State Univ., Tallahassee. Dept. of Meteorology.
SENSITIVITY OF THE MONSOON ONSET TO DIFFERENTIAL HEATING
T. N. Krishnamurti and Y. Ramanathan *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p Sponsored in cooperation with NOAA (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-19363)
Avail: NTIS MF A01; HC WMO

The energetic interaction processes between stream function and velocity potential fields before, during, and after the onset of summer monsoons are examined using monsoon experiment wind data. The acceleration of low level winds at 10 deg N was investigated by a multilevel primitive equation model. The slow northward march of organized convection east and northeast of India is the key factor. This heating generates a preferred orientation of divergent circulations (X) that in turn transfer most of the energy to the rotational modes (Y) via their larger scale (X-Y) interactions. The orientations of the divergent and rotational motion fields define these energy exchanges and precede the active and break periods of monsoons by one week. During these periods the low level flows increase or decrease substantially due to X-Y interactions.
Author (ESA)

N82-23897# Princeton Univ., N. J.
THE SOUTHERN OSCILLATION AND INDIAN MONSOON VARIABILITY
R. N. Keshavamurty *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The sensitivity of sea surface temperature anomalies over the equatorial Pacific and their effects on the global scale, equatorial east-west circulation was studied by a spectral general circulation model. Diabatic heating anomalies during the low index phase of the Southern oscillation (over the equatorial western and central Pacific) induce circulation changes to the drought monsoon circulation over Southeast Asia. These anomalies contribute to annual variations in Asian monsoons. Author (ESA)

N82-23898# National Meteorological Center, Washington, D.C.
SHORT TERM INFLUENCE RADIUS OF MONSOONAL OVERTURNINGS
Julia Paegle (Utah Univ.) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 9 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The FGGE 3 b analyses and NOAA satellite data are used to delineate periods of intense convective activity over the central and western Pacific Ocean. For periods of stronger convection, the transient kinetic energy is relatively stronger over the deep tropics and into the subtropics than for times of less active tropical overturnings. Regions which are predominantly convective correspond to areas where the balance equation is nonelliptic. For these areas only steady states which are strongly divergent and with small or vanishing absolute vorticity are possible.

Correlations of upper level outflows with wind components suggest substantial influence of the tropics upon the subtropics in time scales of 3 days. The need to include tropical processes in numerical weather prediction for tropical and subtropical numerical weather prediction is shown. Author (ESA)

N82-23899# Indian Inst. of Tropical Meteorology, Poona.
IMPACT OF SUMMER MONEX OBSERVATIONAL DATA ON THE OBJECTIVE ANALYSIS OF WIND FIELD OVER THE INDIAN REGION
S. Rajamani, D. R. Talwalker, P. U. Upasani, and D. R. Sikka *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p ref (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The enhanced data base provided by Monex is evaluated by four depressions using: (1) observational data from the conventional observing systems; (2) conventional observational data enhanced by aircraft and ship data; (3) the data of (2) further enhanced by low level cloud wind vectors from a satellite; and (4) conventional observational data enhanced only by the low level cloud wind vectors from a satellite. It is found that aircraft and ship data improve analysis more than satellite data, either due to the greater accuracy of dropsonde and radiosonde data compared to satellite winds, or because the satellite cloud observation may not be at the analytical level. Vector errors decrease significantly over data sparse areas. The impact of additional data is marginal in areas with adequate land stations. Author (ESA)

N82-23900# Indian Inst. of Tropical Meteorology, Poona.
IMPACT OF ADDITIONAL SUMMER MONEX WIND DATA ON THE PREDICTION OF MONSOON DEPRESSIONS DURING JUNE - AUGUST 1979 WITH TWO VERSIONS OF PRIMITIVE EQUATION (PE) BAROTROPIC MODEL
D. R. Sikka, S. Sinha, S. S. Singh, P. L. Kulkanni, and A. A. Kulkarni *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs Sponsored in part by Colorado State Univ. (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The reliability of barotropic prediction and the influence of MONEX data was investigated. Streamlines and isotachs data for 700 mb are analyzed using (1) regular weather station observations and (2) additional data from Monex platforms. Two versions of the P.E. barotropic model, which differ only in the dynamic initialization procedure, are used and it is found that they perform equally well. They perform best on those structures in which the easterly flow is of comparable strength to monsoon westerlies at 700 mb. The impact of additional data is not positive consistently because the easterlies around the depression are weaker than westerlies and the additional data are better defined the westerly maxima. Westward motion of monsoon depression is linked with the convergence ahead of the system and the preferential convection in the forward sector. It is concluded that the P.E. barotropic model is not the best one to study the impact of additional data. Author (ESA)

N82-23901# World Meteorological Organization, Geneva (Switzerland).
THE EVALUATION OF ENERGY INTERACTION OF MESOSCALE FIELDS OF CONVECTIVE CLOUDS WITH LARGE-SCALE MONSOONAL PROCESSES
R. S. Pastushkov *In its* Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Energy interaction of mesoscale convective activity with large scale monsoonal processes is numerical simulated for fields of convective clouds over the ocean. The standard meteorological information of summer Monex about mesoscale space and time nonhomogenity of the lowest atmospheric and oceanic surface layers is used. The equations of vorticity, thermodynamics, and conservation of all water substance are calculated and the parameterization correlation of latent heat and the liquid content of clouds and rain are added. An essential dependence of all convective cloud characteristics on the energy of atmospheric instability, convergence of large scale monsoonal flow, its vertical wind shear, space and time thermal nonhomogenity of lowest atmospheric and oceanic surface layers is shown. Author (ESA)

N82-23902# Hydrometeorological Centre of the USSR (Moscow).
EXPERIMENTAL FORECAST OF THE METEOROLOGICAL ELEMENTS OVER THE SUMMER MONSOON AREA USING THE DIABATIC PRIMITIVE EQUATION (PE) LIMITED AREA MODEL
S. O. Krichak *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 3 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A limited area adiabatic model which includes processes in the upper troposphere and lower stratosphere was developed for numerical forecasting under summer monsoon conditions. Geopotential, wind, and relative humidity field data are used. The model predicts the main precipitation pattern for 24 hr during the premonsoon period. Errors in moisture of the initial data are not essential in the model, with no direct heating due to large scale condensation. It is found that the results of the forecasting of precipitation for shorter time intervals are much more sensitive to variations in the initial moisture fields. Author (ESA)

N82-23903# World Meteorological Organization, Bujunbura (Burundi).
AN OVERVIEW OF WAMEX RESULTS
Samuel MbeleMbong *In* WMO Inern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The origin, objectives and progress in the implementation of WAMEX are reviewed. The significance of the results is examined for WAMEX area countries and the meteorology of West Africa relative to the general atmospheric circulation in the tropics. The effects of the Atlantic, general circulation outside the African region and atmospheric long waves, on the West African monsoon are studied in WAMEX. Benefits from WAMEX include greater understanding of rainfall and other economically significant weather phenomena. Author (ESA)

N82-23904# Direction de la Meteorologie Nationale, Paris (France).
THE CLOUD CLUSTERS: THE MAIN COMPONENT OF SAHELIAN METEOROLOGY
Georges Dhonneur *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The synoptic scale aspects of moving disturbances over the Sahel are considered. The space/time characteristics of the African easterly jet stream (AEJ), the tropical easterly jet stream (TEJ), and their relation with Sahelian rains are discussed. Satellite wind and cloud data are used. A normal rainy season corresponds to an early by weak AEJ and a strong TEJ. A strong but late AEJ and weak TEJ accompany low rainfall. Easterly waves are important over the West African coast and tropical Atlantic. clusters (deep convection clouds lasting 6 hr, surface = 10,000 sq km) determine vertical motion in the structure and maintenance of squall lines over the Sahel. Author (ESA)

N82-23905# Laboratoire de Meteorologie Dynamique, Paris (France).
RADAR AND SATELLITE OBSERVATIONS OF ONSET AND GROWTH OF SEVERE CONVECTIVE STORMS OVER WEST AFRICA DURING WAMEX
Paul OloryTogbe *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The formation of a mesoscale convective system, the clouds which accompany it, and the large scale flow patterns in which the system develops are described. The system is 1600 km long on satellite pictures. It consists of discrete convective elements perpendicular to the low level monsoon current which is less than 1 km deep. As the disturbance line moves westward, easterlies at 700 mb intensify, the monsoonal flow is cut off,

and the layer below 900 mb cools. The heaviest rains fall within a band 10 km wide associated with the individual convective elements and followed by a mesoscale area of light rain which lasts 4 hr. Author (ESA)

N82-23906# Ife Univ., Ile-Ife (Nigeria).
CONVECTIVE ACTIVITY OVER NIGERIA DURING THE MONSOON SEASON
Ekundayo E. Balogun *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Thunder distribution patterns over coastal and inland areas, and meridional movement of convective zones are described. Data from meteorological archives on rainfall, cloud patterns, and wind are used. An intensification of easterly waves between 0 and 10 deg E over West Africa is attributed to instability of the midtropospheric jet and condensation heating by convection. Data confirm the schematic representation in latitudinal zones of the intertropical discontinuity. Author (ESA)

N82-23907# Meteorology Bureau, Boulogne (France).
NUMERICAL FORECASTING EXPERIMENTS ON A TROPICAL AREA
J. Lepas, Y. Bidet, B. Bret, Y. Durand, R. Jourdan, and S. Planton IN WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A primitive equation model for tropical regions is presented. The dynamical part is classical and has 15 levels irregularly arranged, which gives an explicit description of the boundary layer. A C-grid is used for numerical formulation. The physical part handles thermal variations inside the layers, surface radiative fluxes, surface momentum flux, sensible heat, humidity, precipitation, vertical and horizontal diffusion. Trough position and rainfall predictions are close to observed values. Author (ESA)

N82-23908# Miami Univ., Fla.
MONEX OCEANOGRAPHIC OBSERVATIONS ALONG THE EAST AFRICAN COAST
Otis B. Brown and Friedrich Schott *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 16 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Ship, buoy, and satellite current, temperature and air pressure data were used in order to study the Somali current. Wind field development, near surface circulation and upwelling were noted. Temperature, salinity, and potential density were recorded. The salinity profiles show several layers which deviate by more than 0.1 ppt from the mean. The density profile is smooth. So-called anomalous flow and expected flow often occur in the same year. Results suggest a mesoscale ocean-atmosphere interaction driven by the large horizontal difference in ocean surface temperature along the East African coast. Author (ESA)

N82-23909# Naval Physical and Oceanographic Lab., Cochin (India).
ON THE SPACE-TIME VARIABILITY OF OCEAN SURFACE MIXED LAYER CHARACTERISTICS OF CENTRAL AND EASTERN ARABIAN SEA DURING MONSOON-77
R. R. Rao, P. G. K. Murty, M. G. Joseph, and K. V. S. Raman *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Surface mixed layer deepening and cooling of the Arabian Sea, which occurs in a nonhomogeneous manner during the monsoon season, is described. Ship polygons collected data on mixed layer (MLD) characteristics. Average MLD and vertical temperature gradient below MLD were recorded spatially and temporally. Deepening and cooling rates are higher over the central Arabian Sea than over the eastern Arabian Sea. In the central Arabian sea, deepening is greatest at the northern end. In the eastern Arabian Sea the layer deepening is higher at the southern location. The observed deepening shows good agreement with the computed layer depth, considering convective turnover caused by surface cooling. However, wind induced mixing contributes to the observed layer depth more in Phase-1U than Phase-2U. Vertical flow at the base of the mixed layer is upward, causing entrainment of colder waters from the upper thermocline and leading to mixed layer deepening and cooling. Author (ESA)

N82-23910# Wisconsin Univ., Madison.
ESTIMATES OF SEA SURFACE STRESS FOR SUMMER MONEX FROM CLOUD MOTIONS
B. B. Hinton and D. P. Wylie *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-79-13097)
Avail: NTIS MF A01; HC WMO

Numerical modeling of surface wind stress is described. Satellite winds, cloud motions and monthly ship data are analyzed. Cloud motion speed is plotted as a function of the speed measured by a collocated ship. A regression line extrapolates speed from cloud to ship level. Regression relations are exploited for direction changes, e.g. veering. Cloud and ship data are merged in order to produce daily stress maps. Results agree with observed published data. The method is accurate over a wide area, at a 2 deg or more resolution, for several days. Cross correlations indicate that gridded cloud motion measurements error characteristics are compatable with ship wind measurements. Author (ESA)

N82-23911# Wisconsin Univ., Madison.
TIROS-N SOUNDINGS AND RADIATION PARAMETERS FOR WINTER MONEX
David W. Martin, Jennifer Lam, and Dhirendra N. Sikdar *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs Sponsored by NSF (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Tiros N temperature and moisture soundings are compared with in situ observations in the tropics. Temperature and dew point temperature profiles are calculated through linear regression based on statistical coefficients. Satellite results are bad. Satellite temperature is too warm in the lower troposphere and cool in the upper troposphere. Uncertainties in the satellite soundings are greatest near rain and cloud systems and near the coast of China. Satellite soundings are too dry in the middle troposphere. The soundings do offer a useful depiction of temperature on regional scales, and provide a good depiction of temperature gradients. Author (ESA)

N82-23912# Australian Numerical Meteorology Research Center, Melbourne.
THE ONSET OF THE AUSTRALIAN NORTHWEST MONSOON DURING WINTER MONEX: BROADSCALE FLOW REVEALED BY AN OBJECTIVE ANALYSIS SCHEME
B. J. McAvaney, N. E. Davidson, and J. L. McBride *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The structure and time changes of the seasonal movement of the equatorial trough were studied using an univariate, three-dimensional optimum interpolation objective analysis scheme. Wind field and surface pressure are analyzed. Analyses are cycled so that the analysis from 12 hr previous is used as the first guess field. Ships, aircraft, land stations, ocean platforms, satellite and archive data are analyzed. The monsoon onset is a large scale event (10 deg latitude by 30 deg longitude). It is not preceeded by a similar change in the Northern Hemisphere. Forcing comes from changes in the Southern Hemisphere subtropical circulation. These changes are well simulated by numerical prediction models on the 3 to 4 day time scale.
Author (ESA)

N82-23913# Bureau of Meteorology, Darwin (Australia).
INTERHEMISPHERIC INTERACTION DURING WINTER MONEX
Mark Williams *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p ref (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

All synoptic analyses for winter Monex are examined in order to see if surges originating in the South China Sea interact with the northwesterly monsoon in the Southern Hemisphere. One such interaction is identified. Increased convergence west of Borneo generates an eastward propagating wave in the equatorial westerlies to the north of Australia. This wave is clearly visible on satellite pictures moving eastwards at 20 kts from Central Indonesia to east of the Solomon Islands. Author (ESA)

N82-23914# Central Meteorological Service, Peking (China). Academy of Meteorological Science.
THE INTERLOCKING PHENOMENON BETWEEN THE NORTHERN AND THE SOUTHERN HEMISPHERE CIRCULATIONS AND CHINA'S MEI-YU PERIOD IN 1979
Fukang Zhu, Longhua Lu, Xiangding Zeng, and Kai Xu (Nanjine Inst. of Meteorology, China) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The relationship between Northern and Southern Hen...-spheres circulation during the late spring rainy phase (Mei-yu) is studied using spectra of 100 mb geopotential fields at 30 deg N and 30 deg S. The interlocking phenomenon between the upper tropospheric anticyclones occur in the lower middle reaches of the Yangtze River. When the South Asian High in the Northern Hemisphere moves northward over Tibet there is an upper tropospheric anticyclone in the middle part of the southern Indian Ocean which remains there opposite the South Asian High. At the same time, the long wave systems at 500 mb level become quasistationary. The Indian Ocean is one of the most sensitive regions to the seasonal variation over the Northern Hemisphere in early summer. Author (ESA)

N82-23915# Virginia Univ., Charlottesville.
CHANGES IN THE MONSOON CIRCULATION OF THE SOUTH CHINA SEA IMPOSED BY THE SURGE OF 10-12 DECEMBER 1978
R. H. Simpson, B. J. Morrison, and C. Warner *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-79-00233)
Avail: NTIS MF A01; HC WMO

The relationship between a cold surge and monsoon circulation is analyzed using satellite, ship, land station, and aircraft dropsonde data. Relative vorticities and mass-balanced divergences were calculated from analyses of 9 100 mb layers. No clear circulation signature identifies the surge with southward propagating circulation features. The surface wind maximum is displaced north on the 11th. However, southward protrusion of cold air on the 11th is clear in the cross sections of temperature anomalies along the southbound track. The -1.0 C anomaly isopleth at 950 mb moves southward by 1.3 deg/day. The cold intrusion is most prominent at 750 mb on the 11th, increasing the depth of the mixing layer, the height of the inversion, and thus the penetration of convection. Author (ESA)

N82-23916# Virginia Univ., Charlottesville.
STRUCTURE AND DYNAMICAL MILIEU OF THE MONSOON EDDIES OF 16-17 DECEMBER 1978
R. H. Simpson, C. Warner, B. J. Morrison, and J. Simpson *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-79-00233)
Avail: NTIS MF A01; HC WMO

A monsoon vortex was tracked by aircraft in order to analyze its dynamical characteristics. Ship, satellite wind, and land station data were also used. Results suggest that such vortices are eddies in the equatorial trough whose convective products are ephemeral. Their development is modulated more by diurnal changes than by migratory tropical waves. Synoptic scale analysis is inappropriate to predicting precipitation from monsoon vortices, satellite tracking and kinematic methods are more apt. Author (ESA)

N82-23917# Virginia Univ., Charlottesville.
WINTER MONEX CLOUD POPULATIONS FROM AIRCRAFT TIME-LAPSE FILMS
Charles Warner *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-80-12214)
Avail: NTIS MF A01; HC WMO

A cloud map and cloud population statistics obtained by photogrammetry are presented. Cumulus cloud number densities are obtained by standard procedures and translated into percent area coverage by updrafts. Area coverage by dissipating cloud remnants is an order of magnitude greater than that by updrafts. Cloud statistics imply that an area 200 by 200 km is required for satellite monitoring in areas with marked small scale features, e.g. variations of sea surface temperature due to coral reefs. Author (ESA)

N82-23918# Washington Univ., Seattle.
CONVECTION OVER THE SOUTHERN SOUTH CHINA SEA DURING DECEMBER 1978. PART 1: STRUCTURE OF THE CLOUDS AND PRECIPITATION
Robert A. Houze, Jr., Frank D. Marks, Jr. (National Hurricane and Experimental Meteorology Lab., Coral Gables, Florida), Spiros G. Geotis (MIT, Cambridge), and Arthur K. West (Whatcom Community College, Bellingham, Washington) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects in its Monsoon Expt. Apr. 1981 5 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Rawinsonde observations are analyzed in order to determine the nature of convection over the southern South China Sea and its response to monsoon cold surges and diurnal forcings. A diurnal cycle of convective activity occurs throughout December, being forced by land-sea breeze circulations associated with Borneo. Monsoon cold surges enhance the overall level of convective activity within this diurnal cycle. Convection during this winter period is on a mesoscale rather than convective scale with distinct mesoscale circulation features. Direct computations of vertical motion indicate that the air flow in such systems is characterized by mesoscale upward motion above 500 mb and mesoscale downward motion below, consistent with that observed in mesoscale convective systems in other tropical ocean regions. Radar observations show that the system resembles squall lines in structure. Precipitation is stratiform with a well defined melting layer extending across much of the system. Author (ESA)

N82-23919# Colorado State Univ., Fort Collins.
CONVECTION OVER THE SOUTHERN SOUTH CHINA SEA. PART 2: EFFECTS ON LARGE-SCALE FIELDS
Richard H. Johnson and David L. Priegnitz (South Dakota School of Mines and Technology) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
(Grants NSF ATM-80-07462; NSF ATM-80-15347)
Avail: NTIS MF A01; HC WMO

Rawinsonde observations are analyzed in order to determine the nature of convection over the southern South China Sea and its response to monsoon cold surges and diurnal forcings. A diurnal cycle of convective activity occurs throughout December, being forced by land-sea breeze circulations associated with Borneo. Monsoon cold surges enhance the overall level of convective activity within this diurnal cycle. Convection during this winter period is on a mesoscale rather than convective scale with distinct mesoscale circulation features. Direct computations of vertical motion indicate that the air flow in such systems is characterized by mesoscale upward motion above 500 mb and mesoscale downward motion below, consistent with that observed in mesoscale convective systems in other tropical ocean regions. Radar observations show that the system resembles squall lines in structure. Precipitation is stratiform with a well defined melting layer extending across much of the system. Author (ESA)

N82-23920# Hydrometeorological Centre of the USSR (Moscow).
CONVECTIVE ACTIVITY AND WIND DIVERGENCE IN THE AREA OF WINTER MONEX
A Gelnin, A., B. E. Peskov, and A. B. Shupiatsky (Central Aerological Obs.) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoons Expt. Apr.

1981 3 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Deep convective cloud formation and precipitation development near the intertropical convergence zone are described. Upper air data, and surface data on wind, temperature, precipitation and cloudiness from ship observations are analyzed. Persistent high thermal instability and humidity in the whole troposphere are characteristic of the area. Convective activity and its diurnal variations are more intensive in regions where increased values and diurnal changes of wind convergence are observed. Changes of convective activity are related to changes of wind convergence and upward motions in the lower part of the troposphere. Diurnal variations of convective activity with the morning maximum are observed only at a distance of 250 km off shore. This is related to the breeze process. Author (ESA)

N82-23921# Malayan Meteorological Service, Kuala-Lumpur.
WINTER MONEX LEVEL 2B DATA SET
In WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The level 2b data set consists of: winter monsoon experiment global atmospheric research program (MONEX FGGE) type data set (temperature, pilot, surface synopses); winter MONEX non-FGGE, nonmerged data set (agrometeorological, precipitation, radiation, radar, radiometersonde data) and data from U.S.A. data subcenters. Author (ESA)

N82-23922# Center for the Environment and Man, Inc., Hartford, Conn.
AIRBORNE OBSERVATIONS OF ICE PARTICLES IN CONVECTIVE AND STRATIFORM CLOUDS ASSOCIATED WITH WINTER MONSOON PRECIPITATION SYSTEMS
Paul H. Herzegh *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
(Grants NSF ATM-78-00232; NSF ATM-80-17327)
Avail: NTIS MF A01; HC WMO

The origins of the ice particles in monsoon anvil clouds, and their role in precipitation growth and radiation transfer in the clouds are discussed. Radar data, liquid water meter readings, and digital recordings of shadows cast by particles passing through a laser beam are analyzed. Riming growth produces a significant portion of the precipitation in the clouds. It is unclear how much of the liquid water involved in the riming growth is detrained from the deep cumulus convection which initiales development of anvil clouds and how much is condensed in updrafts associated with mesoscale uplift within the clouds themselves. The precipitation trajectories within anvil clouds must be studied in order to relate possible particle growth conditions (revealed by particle type and degree of riming) to specific regions of features of the clouds. Author (ESA)

N82-23923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRUCTURE AND DYNAMICS OF MONSOON DEPRESSIONS: THE MONEX DEPRESSION (JULY 1979)
J. Shukla *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO CSCL 04B

Literature on monsoon formation is surveyed. Monsoon depressions over the Bay of Bengal are caused either by amplification of westward propagating weak disturbances or by downward propagation of the internal jet instability of the easterly jet. Barotropic instability of low level flow helps the growth of weak disturbances. Rapid growth of an already existing weak perturbation is due to CISK. If the disturbance attains adequate amplitude in the lower levels (either by downward propagation of wave energy of by CISK), the low level moisture convergence and latent heat of condensation are utilized more efficiently for the development of a vertically coupled deep disturbance, which along with upper level easterlies contributes to the westward propagation of the disturbance. Absence of strong vertical coupling leads to vertical tilt and decay of the disturbance. Author (ESA)

N82-23924# Massachusetts Inst. of Tech., Cambridge.
DIAGNOSTIC ANALYSIS OF THE MONSOON DEPRESSION OF 3-8 JULY 1979
Frederick Sanders *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Monsoon diagnostics through quasi-geostrophic theory is discussed. The proposition that the spinup of the depression can be accomplished by geostrophic forcing (without representation of cumulus convective effects) is tested. The need for the degree of vertical coupling to be enough to permit both linking and independence in the vertical is considered. The analysis is compared with in situ observations. Stream functions replace geopotential height since wind data are more reliable than pressure data. Calculated motions agree well with observations when divergence effects are allowed to be competitively large, i.e. with very low static stability. Initial spinup is described badly. The bulk effects of cumulus convection must be estimated more accurately. Author (ESA)

N82-23925# Tokyo Univ. (Japan). Inst. of Geophysics.
OBJECTIVE ANALYSIS OF A MONSOON DEPRESSION DEVELOPED OVER THE BAY OF BENGAL DURING SUMMER MONEX
Tsuyoshi Nitta and Kooichi Masuda *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The structure of a monsoon depression during the period from the formative stage to the developing stage is examined using aircraft dropwindsonde and conventional upper air observations. The largest relative vorticity is 0.00015/s in the lower troposphere with the upward motion to the west of its center. The horizontal trough axis of the depression tilts from southwest to northeast and consequently the depression transports westerly momentum northward. The depression gains its kinetic energy from the mean zonal flow. Analysis of the predepression period reveals that large positive relative vorticity results from the weak trough and the north-south variation of the zonal flow along the east-west band at 16 to 18 deg N over the Bay of Bengal. The depression forms slightly to the north of this band. The necessary condition for the dynamic instability is met for the zonal flow averaged over the Bay of Bengal during the predepression period. This instability could initiate the depression. Author (ESA)

N82-23926# Indian Meteorological Dept., New Delhi.
AIR AND WATER VAPOUR TRANSPORTS ASSOCIATED WITH A BAY OF BENGAL DEPRESSION DURING MONEX-79
S. K. Ghosh, M. C. Pant, and V. Dayal *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Large scale distributions of vertically integrated horizontal transports of air and water vapor associated with the monsoon are presented. The total precipitable water in the depression is calculated. Dropwindsonde, radiosonde and rawinsonde data are analyzed. Meridional maxima occur close to the depression center and are located symmetrically on either side of it. The net zonal transport maxima are highly asymmetrical. This is due to the superposition of two scales of motion (the synoptic scale of the monsoon depression, and the planetary scale of the monsoon flow) in the depression field. Author (ESA)

N82-23927# Utah Univ., Salt Lake City.
UPPER TROPOSPHERIC FEATURES OF CONVECTIVE CLOUD COMPLEX SYSTEMS ASSOCIATED WITH A MONSOON DEPRESSION
E. G. Astling, H. G. McRandal, and D. G. Deitch *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

During a Bay of Bengal monsoon depression, convective

cloud system data were collected by satellite imagery and aircraft radar. Temperature and wind observations are used in order to analyze the upper tropospheric thermal structure and kinematic properties of motion fields. Data are analyzed by a successive correction method. Upper tropospheric easterly flow is present throughout the area. Convective activity coincides with a warm region in the upper tropospheric trough. Divergence values are largest ahead of the trough. As the depression weakens, cirrus anvils associated with convection appear on the west side of the depression center. Convective clouds are sheared off by the easterly flow before they reach the tropopause. Author (ESA)

N82-23928*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NUMERICAL PREDICTION OF THE MONSOON DEPRESSION OF 5-7 JULY 1979

J. Shukla, R. Atlas, and W. E. Baker *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO CSCL 04B

A well defined monsoon depression was used for two assimilation and forecast experiments: (1) using conventional surface and upper air data, (2) using these data plus Monex data. The data sets were assimilated and used with a general circulation model to make numerical predictions. The model, the analysis and assimilation procedure, the differences in the analyses due to different data inputs, and the differences in the numerical predictions are described. The MONEX data have a positive impact, although the differences after 24 hr are not significant. The MONEX assimilation does not agree with manual analysis location of depression center. The 2.5 x 3 deg horizontal resolution of the prediction model is too coarse. The assimilation of geopotential height data derived from satellite soundings generated gravity waves with amplitudes similar to the meteorologically significant features investigated. Author (ESA)

N82-23929# Brookhaven National Lab., Upton, N. Y. Atmospheric Sciences Div.

MARINE BOUNDARY LAYER WIND STRUCTURE OVER THE BAY OF BENGAL DURING MONEX-79

S. SethuRaman *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 7 p refs Sponsored by NSF (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

The role of the atmospheric boundary layer in monsoon formation was investigated through a micrometeorological tower which observed turbulent fluxes of heat and momentum over the ocean, a weather station that continuously recorded mean parameters, and pilot balloon observations to a height of 1 km. Wind profiles and surface/layer fluxes of momentum and heat indicate a change in the direction of the heat flux (in a vertical plane). Surface heat flux is upward with small values for cases with large downward heat fluxes in the upper layers. This occurs when the monsoon trough is far northward causing a break in the monsoon. When the trough moves to its normal position, there is a strong convective boundary layer over the Bay of Bengal. Author (ESA)

N82-23930# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

THE ROLE OF THE MIDLATITUDE CIRCULATION PATTERNS IN TROPICAL CYCLONE GENESIS EVENTS

Geoff Love *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 7 p ref (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

Conclusions regarding circulation patterns favorable for tropical storm genesis are deduced from standard analyses of the troposphere three days before genesis, one day before, and during active (wind speed > 33 kts) and quiet periods. In the summer hemisphere a minimum of baroclinic action poleward of the disturbance is favorable for development. In the winter hemisphere a maximum of baroclinic action in the longitude of the developing depression within about 25 deg latitude of the equator is favorable. The height anomalies between quiet and active periods are of the same magnitude in both hemispheres demonstrating that storm genesis is a result of the planetary circulation patterns. Author (ESA)

N82-23931# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologique Dynamique.

EARLY RESULTS FROM THE BALSAMINE EXPERIMENT

Daniel Cadet, Gilles Sommeria, and Sergio Reyes *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 8 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

An experiment to investigate the Indian monsoon through the use superpressure balloons is described and water vapor data are presented. Balloons equiped with pressure, humidity, and temperature sensors record data once per hour. Data are encoded and sent to Tiros N and NOAA 6 satellites. The late onset of the monsoon studied means that half the data describe premonsoon flow rather than synoptic scale atmospheric motions during the monsoon. Data agreement between balloons is good. Water vapor increases markedly as balloons approach India. Author (ESA)

N82-23932# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologique Dynamique.

DYNAMICS OF THE TROPICAL BOUNDARY LAYER, AS DEDUCED FROM CONSTANT LEVEL BALLOON TRAJECTORIES OVER THE INDIAN OCEAN

G. Reverdin and G. Sommeria *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

Horizontal wind equations formulation using data obtained from constant level balloons and associated with a network of eulerian data is discussed. Drag force of the planetary boundary layer over the ocean is calculated. The horizontal velocity equation is calculated from balloon pressure coordinates, lagrangian averaged, taking into account altitude fluctuations due to gas leaking, loading by rain, and envelope temperature variations. Results are averaged by time period and by region. Acceleration computations are averaged by latitude range. Drag coefficients are of the order of -0.00001. Wind veering with height becomes clockwise above 10 deg N. The ratio of balloon velocity to ground wind is larger than 1. Author (ESA)

N82-23933# Main Geophysical Observatory, Leningrad (USSR).

SOME FEATURES OF TURBULENT EXCHANGE IN THE NEAR WATER LAYER OF THE ATMOSPHERE OF INDIAN OCEAN MONSOON REGIONS

A Golovin, I. *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

Quantitative characteristics of dynamic and heat interaction are obtained from the turbulent flows of heat and moisture calculated from ship data. Heat flux through the sea surface is directed from the ocean into the atmosphere. There is no interdiurnal variation. Wind velocity and moisture gradient determine the diurnal trend in latent heat flux. Relative variability of monsoon turbulent fluxes is greater than in other tropical regions, because of the greater variability of the water-air temperature gradient. Relative variabilities of temperature gradient and heat flux decrease as the monsoon flow stabilizes. Time correlation scales are obtained in order to characterize nonhomogeneity of the turbulent flux field. Author (ESA)

N82-23934# Indian Meteorological Dept., New Delhi.

CHANGES IN THE MERIDIONAL CIRCULATION AND PHASES OF THE SUMMER MONSOON

P. S. Pant *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)

Avail: NTIS MF A01; HC WMO

Meridional circulation was studied using a vertical motion field from the weak phase of the monsoon, a revival phase, and a complete break, computed with a quasigeostrophic model. In the Northern Hemisphere a negative stream function is associated with a meridional cell with rising motion to the south and sinking to the north. Eddy fluxes, especially of heat, are larger during

the break than during the active phase. Changes are greatest in the midtrosposphere. Results indicate that the monsoon cell is weakened by the eddy flux at its northern end associated with midlatitude disturbances. Author (ESA)

N82-23935# Saint Louis Univ., Mo.
PRELIMINARY ESTIMATES OF DIVERGENCE, VORTICITY AND WATER VAPOR FLUX OVER DIFFERENT PARTS OF THE ARABIAN SEA EMPLOYING MONEX-79 DATA
Gandikota V. Rao and Clayton T. Webdell *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-02388)
Avail: NTIS MF A01; HC WMO

Horizontal divergence of water vapor flux at different levels and vertical advection at 500 mb of air columns before and during a monsoon are compared with climatological evaporation and precipitation. Dropsonde, ship, and land station data are used. Thermodynamic data were plotted on skew T-log p diagrams and were interpolated where necessary. Flight tracks were plotted. Normal and tangenital components are derived from wind data. Maximum horizontal divergence of water vapor flux is at 700 mb. Weak vertical velocities occur in the north and gentle subsidence in the south. The north shows low level convergence and the south shows low level divergence. The north gains moisture, the south loses it. Author (ESA)

N82-23936# Central Meteorological Service, Peking (China). Academy of Meteorological Science.
SOME OBSERVATIONAL FACTS OF THE TROPICAL EASTERLY JET IN MAY - JULY 1979
Fukang Zhu, Longhua Lu, and Xianji Chen *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 3 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The establishment and behavior of the tropical easterly jet are examined using global grid point data. The 20 m/sec isotach jet first occurs over the southern tip of the Indochinese peninsula in May due to a seasonal circulation characteristic of the upper troposphere during late spring and early summer. The core locations of the jet show phase changes. They are seen over the southern tips of the Arabian, Indian, and Indochinese peninsulas. In midsummer, the location of the jet is frequently over the southern tip of the Arabian peninsula rather than over the Indian peninsula. Meridional land-sea temperature contrast between the Asian and the Indian Oceans, caused by a drop in Arabian Sea surface temperature, maintains the jet in this area. Author (ESA)

N82-23937# Meteorological Office, Poona (India).
A STUDY OF OFFSHORE VORTICES DURING MONEX-79
A. K. Mukherjee and K. C. Shah (Regional Meteorological Centre, Bombay) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The movement of offshore monsoon vortices used to forecast heavy rainfall is described. A target station at Bombay and an indicator station 200 km apart are used. Only heavy (more than 7 cm/day) rainfall is considered since rain itself is a regular feature of this season. Rainfall due to vortices at the indicator station indicates precisely forecasts rainfall at Bombay. Daily mean rainfall data for previous years confirm the accuracy of the method. Author (ESA)

N82-23938# Meteorological Office, Poona (India).
BAROCLINICITY IN THE MONSOON LOWER TROPOSPHERE MONITORED BY THE NATIONAL REMOTE SENSING AGENCY (NRSA) AVRO AIRCRAFT IN MONEX-79
P. V. Joseph *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Wind and temperature data for monsoon systems are analyzed. A midtropospheric cyclone, a monsoon break, and a depression are considered. The systems show considerable baroclinity at 850 mb and 700 mb. The strong temperature gradients observed are directed from land to sea, the land side being warmer by 5 to 8 C. The area of warm air advection in all three systems has large populations of cumulus and cumulonimbus clouds which show the existence of a strong upward motion field. If the lower temperatures are maintained, at least partly by the upward motion of the less humid air streams from the land side (which cool at the rate of 10 C/km upward motion), the upward motions due to warm air advection and the sharp temperature gradients are mutually dependent. Author (ESA)

N82-23939# Main Geophysical Observatory, Leningrad (USSR).
ESTIMATES OF THE STATISTICAL STRUCTURE OF THE ATMOSPHERIC PRESSURE FIELD IN SUMMER MONEX-79 AREA
I. A. Duybkin, E. A. Sosnina, and N. A. Shkabura *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p ref (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Atmospheric pressure measurements (P) obtained from ships and three stationary polygons are presented. Diurnal course values, the temporal correlation structural functions, and their 95% confidence intervals were calculated using data with the diurnal course included and excluded. These show that in the northwest Indian Ocean the mean background of pressure oscillates within the limits 1011, 9 + or - 0, 7gPa and the scatter of singular measurements is within 1011, 9 + or - 2, 8gPa in the premonsoon period. During transition to monsoon circulation it is within 1008, 7 + or - 1, 2gPa and 1008, 7 + or - 3, 7gPa. During the monsoon onset it is 1007, 4 + or - 1, 2gPa and 1007, 4 + or - 3, 2gPa. The mean pressure field variability sigma p shows no significant differences for the polygons. It is within 1,4< sigma p< 1, 7gPa. Author (ESA)

N82-23940# Wisconsin Univ., Madison.
DOMINANT EMPIRICAL MODES IN THE INDIAN SUMMER MONSOON FLOW PATTERNS AT 850 mb
Jon Ahlquist *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)
(Grants NSF ATM-74-23041; NSF ATM-79-26039)
Avail: NTIS MF A01; HC WMO

Fluctuations in 850 mb flow over India and the Bay of Bengal are studied using empirical orthogonal functions (EOF). The U.S. National Meteorological Center (NMC) global analyses provide data. Fluctuations of three empirical modes account for 53% of the total variance. The most important EOF is a large scale strengthening and weakening of the westerlies. The second is associated with the growth of depressions over the head of the Bay of Bengal,, and the third is an east-west oscillation between the Bay of Bengal and Gujarat. Fifty seven other EOFs are necessary to account for the remaining 47% of the variance. The vast majority of those EOFs are noise and have no meaningful physical interpretation. No significant two week oscillation in the summer monsoon is shown. The NMC analyses are fairly reliable over India at 850 mb. Author (ESA)

N82-23941# Birmingham Univ. (England).
TROPOSPHERE CIRCULATION OVER TIBET AND MONSOON FLUCTUATIONS OVER INDIA DURING SUMMER
M. G. Hamilton *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The effect of the Tibetan high on monsoons is examined by contrasting a normal monsoon (1978) and a weak monsoon (1979). Synoptic indices (5 day mean latitude of the 200 mb high, 200 mb geopotential height differences, wind components, and surface pressure) are used to relate the 200 mb ridge over Tibet to the monsoon trough at the surface. Dynamic and thermal fields at 200 mb over Tibet during 1979 differ markedly from those of 1978. Surface pressure fields differ also. Short term (5 to 10 day) fluctuations modulate monsoon activity, given favorable combinations of other influences, such as near equatorial circulation and feedback processes over India and adjacent seas. In 1979 the ridge was in an abnormally high southernly position

delaying the onset and advancing the end of the monsoon.
Author (ESA)

N82-23942# Florida State Univ., Tallahassee.
THE STRUCTURE OF A WELL DEVELOPED SOMALI JET
N. E. LaSeur *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Wind speed, temperature, mixing ratio, and potential temperature charts of the northwest Arabian Sea derived from aircraft data are presented. Results show a strong jet capped by a layer of pronounced stability and baroclinicity sloping markedly from left to right. Horizontal shear is strongest on the left edge and weaker to the right. The jet exhibits variability on space and time scales. Author (ESA)

N82-23943# Louisiana State Univ., Baton Rouge. Inst. of Coastal Studies.
DIURNAL VARIATION OF THE LOW-LEVEL JET
S. A. Hsu *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs Sponsored in cooperation with Office of Naval Research, Arlington, Virginia (For primary document see N82-23851 14-47)
(Grants NSF ATM-78-13388; NSF ATM-80-13644)
Avail: NTIS MF A01; HC WMO

Diurnal variation of the Somalia jet were investigated by collecting simultaneous measurements of wind, temperature, and humidity from radiosondes launched four times daily. Diurnal variation of the pressure gradient is insufficient to explain the diurnal variation of the jet. The speed of the jet increases from 10 to 15 mps during the day to 20 to 23 mps during the night. The cooler temperature associated with the Somali current offshore, originally produced by this jet, feeds back to the atmosphere by enhancing the temperature gradient across the coastal zone. These interactions in turn affect the velocity of the land/sea breeze system along the Somali coast. This diurnal and pulsational phenomenon is further augmented by the existence of the Gulf of Aden and the mountain and valley winds associated with the regional geography. Author (ESA)

N82-23944# Florida State Univ., Tallahassee. Dept. of Meteorology.
HIGH RESOLUTION OBSERVATIONS OF THE EAST AFRICAN LOW-LEVEL JET DURING SUMMER MONEX
Michael D. Moran *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p ref (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The Somali jet and boundary layer inversion over Somalia are discussed. Balloon-borne minisondes recorded pressure and dry bulb and wet bulb temperatures every 30 sec up to 250 mb. Jet speed varies diurnally, with the peak speed occurring at night. Temperature inversion fluctuate throughout the day, with the strongest inversion occurring in the afternoon. A shallow unstable surface layer is present during the day. The strongest ground winds blow in the morning Author (ESA)

N82-23945# All-Union Scientific Research Inst. of Hydrometeorological Information, Moscow (USSR). World Data Centre.
ANALYSIS OF OCEAN AND ATMOSPHERE THERMODYNAMICAL CHARACTERISTICS DURING THE ONSET OF SOUTHWEST MONSOON OVER THE ARABIAN SEA
P. V. Nuzhdin *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 2 p (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Ship surface and oceanographic data are used to analyze the onset of the Arabian Sea monsoon. Areas of marked heat storage, such as the central Arabian Sea are treated as centers of air sea coupling. A positive enthalpy anomaly is formed in this area from April to June, together with the Somali current, determines monsoon intensity. Enthalpy (H) and potential energy (Ep) were computed for the ocean layers 0 to 100 and 0 to 500 m as well as latent heat and sensible heat fluxes in the surface atmospheric layer over the ocean. The difference between the series of these characteristics for the premonsoon period and the period of the steady enthalpy decrease and heat and moisture flux increase is significant. Monsoon onset can be predicted from the moment when H and Ep stop oscillating drastically and H starts decreasing steadily. Author (ESA)

N82-23946# Indian Meteorological Dept., New Delhi.
CERTAIN ASPECTS OF PRE-ONSET AND ONSET PHASE OF SOUTHWEST MONSOON FOR THE DECADE 1970-1979
R. K. Datta, A. V. R. K. Rao, Bhukan Lal, S. R. Puri, and Mahohar Lal *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

The effects of the monsoon trough and sea surface temperature (SST) on the Indian monsoon are discussed. Data are taken from daily charts. The trough and the intertropical convergence zone (ITCZ) move northwards as the monsoon progresses. In years of timely onset and smooth northward progression the ITCZ is north of the trough. As the monsoon advances, dynamic coupling between the lower level thermal trough and the northward advancing equatorial trough is noted. Lull and break monsoon conditions are observed when the troughs at various levels become vertical. A marked anticyclone over the Caspian Sea disrupts the monsoon flow. Easterly jets at 100 mb and lower coincide with monsoon onset. The SST data are too scanty to use as a basis for any conclusions. Author (ESA)

N82-23947# Indian Inst. of Tropical Meteorology, Poona.
SOME ASPECTS OF THE INTER-HEMISPHERIC INTERACTIONS ON THE ONSET OF MONSOON OVER INDIA AS REVEALED BY THE MONEX DATA
D. R. Sikka, S. G. Nagar, and D. K. Paul *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs Sponsored in part by Colorado State Univ. (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Literature on planetary, interhemispheric, and regional processes linked with the summer to winter transition of tropospheric circulation over the Afro-Asian region is summarized. An interhemispheric connection for the Indian monsoon onset is suggested. The planetary scale build up of Northern Hemisphere heat sources and their related divergent wind components are linked to the adjustement of the regional pressure field. The equatorial trough moves northward in response. The trigger to this northward shift is provided by strong pressure forcing in the subtropics of the western South Indian Ocean which results in an abrupt increase in the divergent winds with the consequent switching on of the low level cross equatorial gyre, sudden setting up of the Somali jet, and the genesis of monsoon onset vortex.
Author (ESA)

N82-23948# Illinois Univ., Urbana. Lab. for Atmospheric Research.
A DYNAMICAL STUDY OF THE ONSET CYCLONE OF THE SOUTHWEST MONSOON OF 1979
Mankin Mak and J. C. Y. Kao *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p ref (For primary document see N82-23851 14-47)
(Grant NSF ATM-78-12314)
Avail: NTIS MF A01; HC WMO

The tropical storm that heralded the 1979 Indian monsoon is analyzed. The 850 and 200 mb flows are studied using a quasigeostrophic dynamic model. The overall resemblance between the model unstable disturbance and the onset cyclone confirms that the latter largely develops as a barotropic instability process of the low level westerly jet. Its intensity is confined in the lower troposphere in spite of the strong vertical shear of the basic flow. The observed basic vertical shear is subcritical as far as baroclinic instability is concerned because of the relatively low latitude of the jet. The level of maximum intensity of the onset cyclone is the level of the westerly jet. Once the cyclone develops, it subsequently alters the large scale pressure field to the extent that the low level jet shifts northward, provoking the monsoon onset. Author (ESA)

N82-23949# National Center for Atmospheric Research, Boulder, Colo.
THE NEAR-EQUATORIAL JET SOUTH OF INDIA AND ITS ROLE IN THE ONSET OF THE MONSOON
Joachim P. Kuettner and M. S. Unninayar *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 5 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Indian monsoon prediction using the relation between the low level jet and the equatorial pressure gradient is described. Maximum zonal velocity and latitude of the jet are plotted as a function of the meridional pressure gradient. Geostrophic equilibrium velocities are shown as a function of latitude and meridional pressure. The intersections of the curves define the latitude around which the trajectories oscillate. The latitude of the jet follows the pressure differential curve with a 2 to 3 day time lag. The correlation coefficient is 0.77 significant at the 3% level. Data for five monsoons reveal similar correlations, indicating that monsoon onset forecasting is improved if the time at which critical pressure differentials are reached is predicted accurately. Author (ESA)

N82-23950# Wisconsin-Milwaukee Univ., Milwaukee.
SATELLITE OBSERVED CLOUD FIELDS IN RELATION TO THE ONSET OF SOUTHWEST MONSOON OVER INDIA IN 1979
Dhirendra N. Sikdar and David W. Martin (Wisconsin Univ., Madison) *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 6 p refs (For primary document see N82-23851 14-47)
(NSF ATM-79-20850)
Avail: NTIS MF A01; HC WMO

The nature of the intertropical convergent zone in the equatorial position during monsoon onset, and the relationship between large scale cloudiness and the Somalian jet are investigated. The relationship between deep convective disturbances in the Arbian Sea during the onset phase and the low level and upper level dynamic fields is studied. The northward movements of equatorial cloud bands over the Arabian Sea and the Bay of Bengal are related to convective activity in northeastern India and a strengthening of westerlies over the Arabian Sea. The deep convective clouds occur in regions of strong low level convergence and upper level divergences. Author (ESA)

N82-23951# Oklahoma Univ., Norman.
NUMERICAL STUDIES OVER THE ARABIAN SEA
Frederick H. Carr *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 3 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

Numerical studies using data sets of summer Monsoon Experiment (MONEX) data are listed, including the development of a comprehensive regional objective analysis scheme, numerical prediction experiments, diagnostic studies of Arabian Sea disturbances, and onset vortex case studies. The need for a rainfall atlas for the Arabian Sea phase of summer MONEX over the entire MONEX region is stressed. Author (ESA)

N82-23952# Florida State Univ., Tallahassee. Dept. of Meteorology.
ONSET OF MONSOON IN THE ARABIAN SEA DURING 1979
Y. Ramanathan *In* WMO Intern. Conf. on Early Results of FGGE and Large-Scale Aspects of its Monsoon Expt. Apr. 1981 4 p refs (For primary document see N82-23851 14-47)
Avail: NTIS MF A01; HC WMO

A tropical prediction model which predicts the onset depression of the Indian monsoon is assessed. The significance of convection, barotropic instability, baroclinic instability, and radiation for zonal flow evolution and depression formation are examined. The development and northward movement of the depression are predicted well, as are zonal wind vertical profiles, rainfall, and speed maxima. Flow patterns in the Bay of Bengal and equatorial trough are predicted badly. Energy computations show the dominance of zonal and eddy kinetic energy barotropic processes in the lower levels. Eddy available potential energy and eddy kinetic energy baroclinic processes dominate the upper levels. Low level convergence increases cyclonic vorticity in lower levels. Middle levels become more cyclonic from low level cyclonic advection. Author (ESA)

N82-23953# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
LORING AFB, LIMESTONE, MAINE REVISED UNIFORM SUMMARY WEATHER OBSERVATIONS (RUSSWO), PARTS A-F Final Report
7 Jul. 1981 475 p
(AD-A110047; AD-E850117; USAFETAC/DS-81/074) Avail: NTIS HC A20/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Loring AFB, Limestone, Maine. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface winds; (4) Ceiling versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry bulb temperature, means and standard deviations of dry-bulb, wet bulb and dew point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

N82-23954# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO), PARTS A, C-F, KWANG JU AB, KOREA Final Report
1 Jul. 1981 383 p
(AD-A110048; AD-E850116; USAFETAC/DS-81/077) Avail: NTIS HC A17/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Kwang Ju AB, Korea. It contains the following parts: (1) Weather Conditions; Atmospheric Phenomena; (2) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (3) Surface winds; (4) Ceiling versus Visibility; Sky Cover; (5) Psychrometric Summaries (daily maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry bulb temperature, means and standard deviations of dry-bulb, wet bulb and dew point temperatures and relative humidity); and (6) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

N82-23955# Air Force Environmental Technical Applications Center, Scott AFB, Ill. Data Processing Div.
HIEDELBERG, AAF, GERMANY REVISED UNIFORM SUMMARY OF SURFACE WEATHER OBSERVATIONS (RUSSWO) PARTS A-F Final Report
5 Oct. 1981 415 p
(AD-A110049; AD-E850119; USAFETAC/DS-81/090) Avail: NTIS HC A18/MF A01 CSCL 04/2

This report is a six part statistical summary of surface weather observations for Hiedelberg AAF, Germany. It contains the following parts: (A) Weather Conditions; Atmospheric Phenomena; (B) Precipitation, Snowfall and Snow Depth (daily amounts and extreme values); (C) Surface winds; (D) Ceiling versus Visibility; Sky Cover; (E) Psychrometric Summaries (daily maximum and minimum temperatures, psychrometric summary of wet-bulb temperature depression versus dry bulb temperature, means and standard deviations of dry-bulb, wet bulb and dew point temperatures and relative humidity); and (F) Pressure Summary (means, standard, deviations, and observation counts of station pressure and sea-level pressure). Data in this report are presented in tabular form in most cases in percentage frequency of occurrence or cumulative percentage frequency of occurring tables. GRA

N82-23956# Atomic Energy Control Board, Ottawa (Ontario).
TORNADO RISK IN EASTERN CANADA: A MONTE CARLO APPROACH

G. J. K. Asmis 18 Jun. 1980 16 p refs Presented at the 1st Ann. Conf. of the Canadian Nucl. Soc., Montreal, 18 Jun. 1980
(INFO-0009) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The probability of tornado strikes and the consequent damage that is imposed on nuclear power plants were investigated. A theoretical study employing a Monte Carlo technique was used to simulate the tornado environment for a hypothetical site. This exercise concluded that a site the size of a large nuclear park such as Bruce can be traversed by a tornado every 500 years. The results are very preliminary since very little Canadian data or meteorological considerations have been involved. The results do, however, show that the frequency of a tornado strike is in the order of 10 (-3) events/annum and is therefore of concern in the safety assessment of nuclear facilities. DOE

N82-23957# Stockholm Univ. (Sweden). Dept. of Meteorology.
DIRECT RECORDING OF WIND SECTOR DISTRIBUTIONS IN EXTREME ENVIRONMENTS WITH A WIND VANE
J. Heintzenberg, L. Baecklin, and B. Moberg Jan. 1982 20 p refs Sponsored in cooperation with Norwegian Polar Research Inst.
(Contract SWED-EPB-500-788-80-FF)
(AP-20) Avail: NTIS HC A02/MF A01

A wind vane sectormeter which directly records wind sector distributions for a wide range of sampling times (minutes to hours) is described. Besides a representative wind sector, the instrument displays the variability of the wind during a period of interest and it can be used in sector controlled air pollution sampling even in extreme environments. An arctic winter campaign of air pollution sampling was conducted successfully at wind chill temperatures down to - 60 C. During a two week period, 256 1hr integration runs were recorded. Results show that relative sector distribution of local wind direction can be explained by topographical influences. Author (ESA)

N82-23958# Stockholm Univ. (Sweden). Dept. of Meteorology.
THE EFFECT OF SPATIAL SMOOTHING ON LAGRANGIAN RAINFALL STATISTICS
Mats Hamrud Jan. 1982 16 p refs Sponsored by Nordic Council of Ministers, Oslo
(CM-55) Avail: NTIS HC A02/MF A01

The spatial smoothing of rainfall data by interpolation to grid points is discussed with emphasis on the effect on parameter values and their relative magnitudes, i.e., the relation between Eulerian and Lagrangian estimates. The average time from an arbitrary moment in a dry period to the end of that period was estimated from weather station and interpolated grid point data. The importance of lack of data over the sea was examined. Areas of the sea were removed from calculations. Results show that Eulerian data can be used for rough estimates of Lagrangian rainfall characteristics. Neither the Lagrangian/Eulerian problem nor the problem of spatial interpolation of precipitation data are serious when estimating removal rates to be employed in statistical long-range transport models. The most serious problem with the precipitation data is the systematic error introduced when letting the model generate artificial data.
Author (ESA)

N82-23959# Research Inst. of National Defence, Stockholm (Sweden).
DROP SIZE DISTRIBUTION IN RAIN
Sture Wickerts Jan. 1982 18 p refs
(Contract FMV-F-R-84302-72-180)
(FOA-C-20438-E1(E2)) Avail: NTIS HC A02/MF A01

A set of one-minute-data of rain intensity and drop size distribution were analyzed, based on the relationship derived by Marshall and Palmer (MP). The three constants in the MP equation were calculated. The exponent, P sub 2 is 0.21, the same value as in MP, for all types of rain. The constant P sub 1 = 3.8, with no significant difference between types of rain. The constant N sub zero evaluated from widespread rain, drizzle, and showers gives N sub zero = 6000 R to the minus 0.15 power. Mean value = 6035, standard deviation = 1005. With data only from showers, the constant is 5840, the exponent is 0.08, and the standard deviation is 2100. The radar parameter Z equals 380 R to the 1.32 power. Author (ESA)

N82-23960# Research Inst. of National Defence, Stockholm (Sweden).
WIND PROFILE MEASUREMENTS WITH SODAR
Sture Wickerts and Mats Hurtig Jan. 1982 13 p refs Original contains color illustrations
(FOA-C-20439-B2(D2)) Avail: NTIS HC A02/MF A01

A remote sensing system, used to measure wind profiles in the lowest part of the atmosphere is described. The method is based on measurements of the Doppler shift of backscattered acoustic pulses. Signals are sampled at a 5 sec pulse rate for 500 m altitude, or 10 sec for 1000 m. Integrated values are processed in order to give one vertical and two horizontal wind vector components. The formulas for calculating scattered acoustic energy are given. Results are compared with in situ tower measurements. Differences are very small. Author (ESA)

N82-23961# Department of Agriculture, Washington, D.C. Statistical Reporting Service.
STOCHASTIC SIMULATION OF DAILY CLIMATE DATA
Greg A. Larsen and Roberta B. Pense Sep. 1981 67 p refs
(PB82-120791; AGES-810831) Avail: NTIS HC A04/MF A01 CSCL 04B

A stochastic weather simulation model for generating daily climate data was developed. This model was expanded and modified to generate possible sequences of daily precipitation, maximum and minimum temperature and solar radiation for an entire year. A first order, two-state Markov chain simulates precipitation occurrence with the amount of precipitation then calculated from a two-parameter gamma probability distribution the model is described and the results of validation tests are given. Author (GRA)

N82-23962# North American Weather Consultants, Inc., Salt Lake City, Utah.
CONTINUING DESIGN WORK FOR THE SIERRA COOPERATIVE PILOT PROJECT Interim Report
R. D. Elliott, D. A. Griffith, John A. Flueck (Flueck Associates, Wyncote, Pa.), and Jack A. Hannaford (Sierra Hydrotech) Sep. 1981 287 p refs
(Contract DI-7-07-83-V0008)
(PB82-136607; SLWM-81-3; IR-4) Avail: NTIS HC A13/MF A01 CSCL 04B

Nine task forces were organized to address analysis of field data. Seeding scenarios were developed for several precipitation echo types, one of which was concerned with seeding major bands with aircraft, and convection with ground based sources. Treatment design, a seeding guidance model, suspension criteria, extra area effects, and a statistical evaluation are included. A precipitation gage network to detect precipitation from postfrontal convective cells was studied. N.W.

N82-23963# Intermountain Forest and Range Experiment Station, Ogden, Utah. Aviation and Fire Management Staff.
REMOTE AUTOMATIC WEATHER STATION FOR RESOURCE AND FIRE MANAGEMENT AGENCIES
John R. Warren and Dale L. Vance Aug. 1981 15 p refs
(PB82-107335; FSGTR/INT-116) Avail: NTIS HC A02/MF A01 CSCL 04B

A weather station that operates automatically in remote areas, without power or communication lines was developed and is commercially available. Remote automatic weather stations (RAWS) transmit precipitation, windspeed, air temperature, temperature, humidity, and barometric pressure data via satellite. Data may be acquired by direct dialing or through a fire forecasting program. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N82-23964# Texas A&M Univ., College Station.
EFFECTS OF SHOALING BOTTOM TOPOGRAPHY ON THE

DYNAMICS OF GULF STREAM CYCLONIC RINGS Ph.D. Thesis
James Roland Haustein 1981 273 p
Avail: Univ. Microfilms Order No. 8128894

A two-layer, rigid-lid model of a Boussinesq, quasi-geostrophic ocean, based on the vertically-integrated equations of motion, was used on a beta plane to study the processes involved as an initially-Gaussian cyclonic ring translates into a continental shelf. Initial tests of geostrophy, rotation, nonlinearity, lateral friction effects and topography yielded values of energy decay and partitioning and centroid propagation speeds in close proximity to those predicted by and extrapolated from linear theory. A series of six 60-day simulations, based on the parameterization of an actual Gulf Stream-derived ring, were used to study the combined effects of baroclinicity (defined as the ratio of maximum lower layer velocity maximum upper layer velocity) and topography as a ring propagates up a numerical parameterization of the Blade Plateau. Model results are compared to actual ring measurements and subsequent data analyses. Dissert. Abstr.

N82-23965# California Univ., Berkeley.
WAVE-CURRENT INTERACTION Ph.D. Thesis
Nabil Mohamed Ismail-Awadalla 1981 150 p
Avail: Univ. Microfilms Order No. 8200145

The interaction of surface gravity waves with steady non-uniform current was studied. Emphasis is given to some effects of viscosity on the waves and current modifications. These effects of viscosity include the wave momentum fluxes (or wave Reynolds momentum fluxes) arising from viscous action at the bottom boundary, and the vertical shear of the current.
Dissert. Abstr.

N82-23966# Old Dominion Univ., Norfolk, Va. Dept. of Oceanography.
HYDROGRAPHIC AND FAUNAL SURVEY OF VMRC TOWER REEF
Carvel Blair and David L. Feigenbaum Mar. 1981 19 p
Avail: NTIS HC A02/MF A01

A survey was conducted of the artificial reef constructed by Virginia Marine Resources Commission (VMRC) on kilometer (0.5 nm) southwest of Chesapeake Light Tower. The hydrographic survey revealed depths ranging from about 17 to 23 m (55 to 77 ft) below mean sea level. The reef area designated by VMRC forms a rough parallelogram. Its long axis measures about 640 m (700 yd) and lies in a direction 030 to 210 degrees true. Its short axis measures about 450 m (500 yd) and runs east-west. The area lies on the east slope of a trough paralleling the long axis. The hydrographic survey showed a few 'spiles' or 'humps' in the bottom, but in general did not distinguish the 200,000 tires comprising the reef from the adjacent bottom. A module of about 60 tires was brought to the surface. Fauna attached to and trapped in the module included both attached and mobile organisms of 12 different species. B.W.

N82-23967# Old Dominion Univ., Norfolk, Va. Dept. of Oceanography.
ISOPYCNAL TEMPERATURE-SALINITY DIAGRAMS
Ronald E. Johnson and Fred A. Hilder Jan. 1981 61 p refs (TR-41) Avail: NTIS HC A04/MF A01

The Knudsen values of sigma-t are provided in graphical format for a temperature range of -2 C to 40 C and salinity range of 0% to 40%. Limitations of the Knudsen values, particularly in the low salinity ranges, are discussed. A sample FORTRAN program used to generate the plot on a VARIAN plotter is provided. Author

N82-23968# Institute of Oceanographic Sciences, Birkenhead (England). Bidston Obs.
AN ANALYSIS OF A YEAR OF SEA-LEVEL DATA AT FLAT HOLM, SEVERN ESTUARY
J. J. Evans and D. T. Pugh 1981 21 p refs Sponsored by UK Dept. of Energy
(IOS-129) Avail: NTIS HC A02/MF A01

Sea-level data were analyzed in order to investigate annual tidal variations. Data for a period when the recorder was damaged were deduced from readings from another site. The annual modulation in the amplitude of the principal semidiurnal lunar tide, M sub 2, is significantly larger than that normally found around Britain, but comparison with analyses of 1885 data shows no measureable secular change in M sub 2.
Author (ESA)

N82-23969# National Oceanic and Atmospheric Administration, Rockville, Md. Ocean Technology and Engineering Services.
SIMULATIONS OF THE IMPACT OF INHOMOGENEOUS WATER COLUMNS ON THE TEMPORAL STRETCHING OF LASER BATHYMETER PULSES
Gary C. Guenther and Robert W. L. Thomas Aug. 1981 45 p refs Prepared in cooperation with EG and G Washington Analytical Service Center, Rockville, Md.
(PB82-128224; NOAA-TR-OTES-02; NOAA-81100503) Avail: NTIS HC A03/MF A01 CSCL 08J

The potential impact of optical inhomogeneities in the water column in inducing errors in bias correctors for pulse stretching effects for a bathymetric lidar is determined when the correctors are derived on the assumption of a homogeneous column. The existing Monte Carlo radiative transfer simulation program was modified to allow convenient simultaneous estimation of the impulse response functions for a number of different vertical distributions of scatterers and absorbers. Outputs were obtained for vertical optical depths up to 16, six different values of single scatter lbedo, and two nadir angles in air -- namely, 0 and 25 degrees. A digital convolution was performed over an anticipated source pulse profile to obtain the 'environmental response function' (ERF), and biases were estimated by applying the same linear fractional threshold to both the source pulse and the ERF and comparing the results to the actual simulated depths. The use of correctors derived for the homogeneous case is likely to result in errors of less than 10 cm. GRA

N82-23970# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environment Lab.
CIRCULATION IN THE LOWER COOK INLET, ALASKA
R. D. Muench (Science Applications, Inc., Bellevue, Wash.), J. D. Schumacher, and C. A. Pearson Jul. 1981 34 p refs
(PB82-126418; NOAA-TM-ERL-PMEL-28; CONTRIB-531; NOAA-81092902) Avail: NTIS HC A03/MF A01 CSCL 08C

Regional flow field data in the lower Cook Inlet region is presented. These data include current observations from taut wire moorings, drogued surface buoy trajections, doppler-shift radar surface current observations, and hygrographic measurements. This field program was concieved primarily to aid in prediction of spilled contaminant fates and trajectores because of petroleum exploration and development in lower Cook Inlet.
GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N82-23971# Washington Univ., Seattle. Dept. of Genetics.
NUMERICAL METHODS FOR INFERRING EVOLUTIONARY TREES
Joseph Felsenstein Sep. 1981 42 p refs
(Contracts DE-AM06-76RL-02225; DE-AT06-76EV-71005)
(DE82-002295; DOE/EV-71005/61) Avail: NTIS HC A03/MF A01

For discrete characters whose ancestral states are known, the prescriptions of Hennig are well-defined, but their applicability only when there is no incompatibility between different characters has led to the elaboration of a number of methods for dealing with incompatibilities. One category is the parsimony methods, which choose that phylogeny on which the fewest changes of character state need be assumed. Another is the compatibility methods, which choose that phylogeny which is perfectly compatible with the largest number of characters, irrespective of how many changes need be assumed in other characters. Other approaches include the use of phenetic clustering algorithms and methods fitting trees to similarity or distance matrices. Each method has different implicit assumptions concerning the biology of the characters and the information available in the data. The biological assumptions and statistical behavior of each method are discussed. T.M.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N82-23972# Clemson Univ., S.C.
A STATISTICAL MODEL OF THE CONTROLLER FUNCTIONS OF THE HUMAN TEMPERATURE REGULATING SYSTEM Ph.D. Thesis
Jeffrey Leo Ringuest 1981 128 p
Avail: Univ. Microfilms Order No. 8126923

A model of the controller mechanisms of the human temperature regulating system was developed. In this context, three different controller responses were examined including: increases in metabolic heat production, increases in evaporative heat loss and modifications in surface blood flow. Additionally, upper and lower limits for each of these controller functions were researched. The relationship between the environmental temperature and the controller model form and parameters was investigated. Finally, it was necessary to statistically test the validity of the controller model that was developed. Data was analyzed using a least squares approach. This procedure involved fitting an equation to a controller response for a limited temperature range. A model of human responses to temperature stress in an air environment and in a water environment was developed which proved to be valid for a wide range of experimental conditions. Dissert. Abstr.

N82-23973# Mississippi Univ., University.
THE EFFECTS OF VARYING EXERCISE INTENSITIES AND DURATIONS ON PLASMA HIGH DENSITY LIPOPROTEIN-CHOLESTEROL, BODY COMPOSITION AND MAXIMUM OXYGEN CONSUMPTION Ph.D. Thesis
Thomas John Birk 1981 169 p
Avail: Univ. Microfilms Order No. 8128089

Forty-three sedentary men twenty-three to thirty-eight years of age after being randomly assigned to either one of four experimental treatment groups or an inactive control group completed a fifteen week, three day per week experimental exercise training period. Results indicated that high density lipoprotein-cholesterol was increased during a seven and one-half to fifteen weeks, three days per week, exercise program of moderate intensity and lower to moderate duration. Percent body fat was decreased most effectively by a higher intensity of workload. A higher intensity and longer duration (80 percent of the difference for thirty minutes) was more effective than other exercise intensities and durations for significantly increasing maximum oxygen consumption. There was also a significant inverse relationship between maximum oxygen consumption and percent body fat at seven and one-half and fifteen weeks of three days per week jogging exercise. Dissert. Abstr.

N82-23974* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY (SUPPLEMENT 231)
Apr. 1982 88 p
(NASA-SP-7011(231); NAS 1.21:7011(231)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 284 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1982. T.M.

N82-23975# Medical Biological Lab. RVO-TNO, The Hague (Netherlands).
DISTURBANCES IN THE CARBOHYDRATE METABOLISM IN SHOCK. 3: EXPERIMENTAL HEMORRHAGIC SHOCK AND SOME SHOCK MODELS. REVIEW OF THE LITERATURE
C. vanderMeer Jun. 1980 81 p In DUTCH; ENGLISH summary
(MBL-1980-10; TDCK-71318) Avail: NTIS HC A05/MF A01

Literature concerning disturbances in the carbohydrate metabolism in experimental hemorrhagic shock, traumatic shock, burns and cardiac shock is reviewed. General observations are a hyperglycemia especially in the early stages of shock (presumably caused by an increased release of catecholamines), sometimes followed in later stages by glycogen depletion in the liver and hypoglycemia. In addition an increased level of plasma lactate and pyruvate, acidosis and a decrease in energy rich phosphates in a number of organs are found. Except for the assumption that these changes may be caused by hypoxia in the liver and other organs, as yet nothing is known with certainty about the origin and nature of the disturbances in the carbohydrate metabolism. Therapeutic effects a.o glucose, glucose-insulin-KC1, glucocorticoids, ATP-MgCl2, naloxone, neuroleptics and neuroleptanalgesia and the adrenergic blocking agents WR-149, 024 and WR-2823 are described. S.L.

N82-23976*# Thermo Electron Corp., Waltham, Mass.
EVALUATION OF LEFT VENTRICULAR ASSIST DEVICE PUMP BLADDERS CAST FROM ION-SPUTTERED POLYTETRAFLUORETHYLENE MANDRELS
Mar. 1982 103 p refs
(Contract NAS3-22476)
(NASA-CR-167904; NAS 1.26:167904; TE200-230-82) Avail: NTIS HC A06/MF A01 CSCL 06B

A highly thromboresistant blood contacting interface for use in implanatable blood pump is investigated. Biomaterials mechanics, dynamics, durability, surface morphology, and chemistry are among the critical consideration pertinent to the choice of an appropriate blood pump bladder material. The use of transfer cast biopolymers from ion beam textured surfaces is investigated to detect subtle variations in blood pump surface morphology using Biomer as the biomaterial of choice. The efficacy of ion beam sputtering as an acceptable method of fabricating textured blood interfaces is evaluated. Aortic grafts and left ventricular assist devices were implanted in claves; the blood interfaces were fabricated by transfer casting methods from ion beam textured polytetrafluorethylene mandrels. The mandrels were textured by superimposing a 15 micron screen mesh; ion sputtering conditions were 300 volts beam energy, 40 to 50 mA beam, and a mandrel to source distance of 25 microns. S.L.

N82-23977# Royal Naval Personnel Research Committee, London (England).
[MEDICAL RESEARCH OF NAVAL PERSONNEL] Progress Report, Jan. 1979 - Jul. 1981
Jul. 1981 15 p refs
(RNP-3/81; BR82205) Copyright. HC A02/MF A01

Research into biological, medical, physiological and psychological problems affecting the health and fighting efficiency of naval personnel is summarized. No safe and simple test of the physical fitness of an individual on a single occasion was found. The cognitive efficiency of divers is impaired during prolonged dives at depths > 300 m. No long-term adverse effects result from breathing air with C02 level = 0.5%. For C0, 15 ppm in air is safe. Afterdrop in deep body temperature, following cold water immersion can be accounted for by a physical mechanism; postimmersion death is attributed to vasomotor collapse. Maximum noise exposure levels recommended for divers working near sonar sources are 175 db for nonhooded and 185 db for hooded divers. Motion sickness affects 75% of sailors during their service life. When a 25 man liferaft is closed down, toxic levels of C02 are reached within 25 min. Author (ESA)

N82-23978# Kentucky Univ., Lexington. Biomedical Engineering Lab.
RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES Progress Report, 1 Oct. 1980 - 30 Sep. 1981
Charles F. Knapp, Joyce M. Evans, and David C. Randall Nov. 1981 66 p refs
(Grant AF-AFOSR-0039-80; AF Proj. 2312)
(AD-A110494; AFOSR-82-0019TR) Avail: NTIS HC A04/MF A01 CSCL 06/19

The research effort of the past year was divided into three phases, each of which adds to our systematic investigation of the frequency response characteristics of cardiovascular regulation. The frequency response characteristics are obtained from the analysis of pressure, flow and heart volume responses to low frequency, sinusoidal acceleration (0.001 to 0.25 Hz + or - 2gz). The 3 phases are: (1) Heart volume measurements in unblocked and autonomically blocked, normal and cardiac denervated dogs undergoing low frequency +2g sinusoidal

acceleration; (2) Comparison of autonomic effector blockade with ganglionic blockade; and (3) The effect of cardiac denervation on cardiovascular function before and after autonomic effector blockade. GRA

N82-23979# London Univ. (England). School of Hygiene and Tropical Medicine.
HEALTH HAZARDS OF VISUAL DISPLAY UNITS WITH PARTICULAR REFERENCE TO OFFICE ENVIRONMENTS
Rachel Birnbaum 1981 13 p refs
(PB82-120627) Avail: NTIS HC A02/MF A01 CSCL 06J

The interaction of man and the visual display unit (VDU) takes place during major tasks, which may make up the greater part of the job of the worker. The occupational health effects of VDUs derive primarily from the effects of long exposure of the worker to the light, reflection, glare and flickering of the CRT screen. The majority of problems therefore tend to be perceptual and the precipitating causes tend to be multiple and interactive. These and other ergonomic problems of the VDU operator are summarized. T.M.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N82-23980# Dayton Univ., Ohio. Research Inst.
CONDUCTING STUDIES OF TRANSFER OF LEARNING: A PRACTICAL GUIDE Final Report
Thomas A. Payne Brooks AFB, Tex. AFHRL Jan. 1982 32 p refs
(Contract F33615-77-C-0054; AF Proj. 1123)
(AD-A110569; AFHRL-TR-81-25) Avail: NTIS HC A03/MF A01 CSCL 05/9

This is a guide for use by the practical researcher concerned with conducting studies of transfer from pretraining of pilots in ground-based environments to performance in aircraft. While the material addresses principally transfer of learning of pilots, many of the issues should be applicable to other contexts, to include training of other aircrew members or even individuals who have quite different tasks to perform. The paper does not deal with theory but, rather, is concerned entirely with method of the transfer study. Method issues, to include the planning, tasks students, performance measurement, instructors, and analyses, are central to arriving at precise estimates of transfer effects--approaching as closely as possible the maximum that might have been demonstrated, providing a goal for the operational instructor pilot. Study models discussed include those for percent transfer of learning and the for transfer effectiveness ratio. Use of the latter should be essential in providing answers to contemporary questions concerning how much simulator pretraining can be used to replace aircraft training time--without reducing the goodness of the end product, the combat effective pilot. Author (GRA)

N82-23981# Minnesota Univ., Minneapolis. Dept. of Psychology.
DIMENSIONALITY OF MEASURED ACHIEVEMENT OVER TIME
Kathleen A. Gialluca and David J. Weiss Dec. 1981 45 p refs
(Contract N00014-79-C-0172; RR0420401; NR Proj. 150-433)
(AD-A110955; RR-81-5) Avail: NTIS HC A03/MF A01 CSCL 05/10

Some type of difference or change score is frequently used to quantify the effects of experimental treatments and educational programs on individuals and on groups of individuals. Whether the change measurement involves the use of simple difference scores, their derivatives, or some more complex methodological design, the measurement process itself assumes that the treatment or instruction results in higher levels of the originally measured variable and that the only change that occurs is a quantitative one. If this assumption is not met, then the computation of any type of difference score is inappropriate and the scores themselves are useless for measuring growth or change. Two studies investigated the tenability of the assumption that classroom instruction results in increases in students' achievement levels while the qualitative nature of that achievement remains constant across time. The data utilized were the item responses to tests in basic mathematics and in general biology administered as pretests and after instruction to students enrolled in those courses. Results included that this assumption was not tenable in the biology data set, where increases in mean achievement level were accompanied by corresponding changes in the factor structure underlying the item responses. For the mathematics data, however, there was no such violation of the assumption: As student achievement levels increased the underlying factor structure remained unchanged. The implications of these results for psychology, education, and program evaluation are noted. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N82-23982*# Metrics, Inc., Atlanta, Ga.
CELSS SCENARIO ANALYSIS: BREAKEVEN CALCULATIONS Final Report
Robert M. Mason Apr. 1980 42 p refs
(NASA Order A-70035B)
(NASA-CR-166319; NAS 1.26:166319) Avail: NTIS HC A03/MF A01 CSCL 06H

A model of the relative mass requirements of food production components in a controlled ecological life support system (CELSS) based on regenerative concepts is described. Included are a discussion of model scope, structure, and example calculations. Computer programs for cultivar and breakeven calculations are also included. B.W.

N82-23983*# Texas Univ., Austin. Dept. of Zoology.
LITERATURE REVIEW OF HUMAN MICROBES' INTERACTION WITH PLANTS
Bassett Maguire, Jr. Aug. 1980 217 p refs
(NASA Order A-77042)
(NASA-CR-166330; NAS 1.26:166330) Avail: NTIS HC A10/MF A01 CSCL 06C

Human carried microorganisms, which cannot practically be excluded from human supporting agricultural systems of extra terrestrial stations, are considered. These microorganisms damage the plants on which the people depend for oxygen and food. The inclusion of carefully screened or constructed, but more or less normal, phylloplane and rhizosphere microbial communities is studied. S.L.

N82-23984*# New Hampshire Univ., Durham. Complex Systems Research Center.
AN APPROACH TO THE MATHEMATICAL MODELLING OF A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM
Maurice M. Averner Aug. 1981 78 p refs
(Contract NAS2-10133)
(NASA-CR-166331; NAS 1.26:166331) Avail: NTIS HC A05/MF A01 CSCL 05H

An approach to the design of a computer based model of a closed ecological life-support system suitable for use in extraterrestrial habitats is presented. The model is based on elemental mass balance and contains representations of the metabolic activities of biological components. The model can be used as a tool in evaluating preliminary designs for closed regenerative life support systems and as a method for predicting the behavior of such systems. T.M.

N82-23985*# Purdue Univ., Lafayette, Ind. Dept. of Horticulture.
NUTRITIONAL AND CULTURAL ASPECTS OF PLANT SPECIES SELECTION FOR A CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM
J. E. Hoff, J. M. Howe, and C. A. Mitchell Mar. 1982 129 p refs

(Grants NsG-2401; NsG-2404)
(NASA-CR-166324; NAS 1.26:166324) Avail: NTIS HC A07/MF A01 CSCL 06H

The feasibility of using higher plants in a controlled ecological life support system is discussed. Aspects of this system considered important in the use of higher plants include: limited energy, space, and mass, and problems relating to cultivation and management of plants, food processing, the psychological impact of vegetarian diets, and plant propagation. A total of 115 higher plant species are compared based on 21 selection criteria. B.W.

N82-23986# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
SAFE WEARING TIMES FOR IMPERMEABLE CHEMICAL PROTECTIVE CLOTHING
W. A. Lotens [1982] 15 p refs In DUTCH; ENGLISH summary
(IZF-1980-11; TDCK-75010) Avail: NTIS HC A02/MF A01

Computer assisted calculations were made to predict the course of the rectal temperature and heat storage of a working man, wearing impermeable protective garments. The calculations were based on the Givoni-Goldman system as well as on a developed heat exchange model. The results are different and the latter model seems to have a slight preference. Safety limits are given in terms of work-rest ratios for long wearing times and in terms of tolerance times for continuous work and for various values of climate and work. Author

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N82-23987*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROJECT OASIS: THE DESIGN OF A SIGNAL DETECTOR FOR THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE Final Report
Steven Lord, ed. (Massachusetts Univ.), Robert Dixon, ed. (Ohio State Univ.), and Timothy Healy, ed. (Santa Clara Univ.) 1981 445 p refs
(Grant NGT-05-017-998)
(NASA-TM-84738; NAS 1.15:84738) Avail: NTIS HC A19/MF A01 CSCL 06C

An 8 million channel spectrum analyzer (MCSA) was designed the meet to meet the needs of a SETI program. The MCSA puts out a very large data base at very high rates. The development of a device which follows the MCSA, is presented. S.L.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N82-23988*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DETERMINATION OF EIGENVALUES OF DYNAMICAL SYSTEMS BY SYMBOLIC COMPUTATION
James C. Howard Apr. 1982 20 p refs
(NASA-TM-84223; A-8850; NAS 1.15:84223) Avail: NTIS HC A02/MF A01 CSCL 12A

A symbolic computation technique for determining the eigenvalues of dynamical systems is described wherein algebraic operations, symbolic differentiation, matrix formulation and inversion, etc., can be performed on a digital computer equipped with a formula-manipulation compiler. An example is included that demonstrates the facility with which the system dynamics matrix and the control distribution matrix from the state space formulation of the equations of motion can be processed to obtain eigenvalue loci as a function of a system parameter. The example chosen to demonstrate the technique is a fourth-order system representing the longitudinal response of a DC 8 aircraft to elevator inputs. This simplified system has two dominant modes, one of which is lightly damped and the other well damped. The loci may be used to determine the value of the controlling parameter that satisfied design requirements. The results were obtained using the MACSYMA symbolic manipulation system. M.G.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N82-23989# Yale Univ., New Haven, Conn.
SECONDARY STORAGE METHODS FOR SOLVING SYMMETRIC POSITIVE DEFINITE, BANDED LINEAR SYSTEMS Ph.D. Thesis
John Richard Perry 1981 172 p
Avail: Univ. Microfilms Order No. 8125692

The Cholesky method for factoring banded symmetric positive definite matrices which arise in finite difference and finite element simulations is considered. Methods for using secondary storage in cases where there is not enough primary memory to compute the band Cholesky factorization are developed and analyzed. The performance of virtual memory paging systems which automatically perform the disk input/output (I/O) necessary to execute programs that do not fit into primary memory was investigated. Techniques for reducing the paging costs of the band Cholesky algorithm are identified. Secondary storage methods that explicitly deal with the use of memory and I/O in computing the Cholesky factorization are presented. The methods are based on partitionings of the band elements into strips containing columns of the band, or blocks, containing submatrices. The costs for each method were analyzed and it is demonstrated that secondary storage methods offer a more efficient tradeoff between memory usage and I/O costs than does paging. Further, the memory occupancy costs of these methods are shown to be as low, asymptotically, as those of any direct or iterative method for solving linear systems in primary memory. Storage and I/O schemes for secondary storage methods that allow I/O to be overlapped with computation are presented. These methods were implemented on a DEC system 2060 using secondary disk storage. Dissert. Abstr.

N82-23990*# Michigan Univ., Ann Arbor. Systems Engineering Lab.
A BIBLIOGRAPHY ON FORMAL METHODS FOR SYSTEM SPECIFICATION, DESIGN AND VALIDATION
J. F. Meyer, D. G. Furchtgott, and A. Movaghar Jan. 1982 41 p
(Grant NsG-1306)
(NASA-CR-168849; NAS 1.26:168849; Rept-014524-19-T; UMICH-SEL-163) Avail: NTIS HC A03/MF A01 CSCL 09B

Literature on the specification, design, verification, testing, and evaluation of avionics systems was surveyed, providing 655 citations. Journal papers, conference papers, and technical reports are included. Manual and computer-based methods were employed. Keywords used in the online search are listed. N.W.

N82-23991# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
THE IMPLICATIONS OF VLSI ROM CHIPS ON NUMERICAL ANALYSIS Interim Technical Report
L. J. Feeser, M. F. Rooney, and M. S. Shephard 8 Jan. 1982 61 p refs
(Contract N00014-80-C-0712)
(AD-A110593) Avail: NTIS HC A04/MF A01 CSCL 09/2

This report presents a detailed overview of the impact of read-only memory (ROM) chips on computing, and more specifically, numerical analysis. A review of the impact of VLSI technologies is given to indicate the role of ROM chips. A review of available ROM technologies is presented including ROM, PROM, and EPROM chips. A discussion of data storage on ROM is

presented covering the mechanics of ROM usage, potential speed increases, programming interfaces, and preparation of data ROM chips through down-line loading. Software on ROM, known as firmware, is discussed similarly and two commercial examples of firmware are presented. Final conclusions highlight the importance of ROM chips for the numerical analyst. GRA

N82-23992# Mess plus System Technik G.m.b.H., Oberschleissheim (West Germany).
MICROPROCESSOR CONTROLLED DATA LOGGER Final Report
Michael Horvatin Bonn Bundesministerium fuer Forschung und Technologie Dec. 1981 20 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-211; ISSN-0340-7608) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4,20

Two models of a microprocessor controlled data logger family, based on an earlier concept, were developed. All main modular components of both models were developed and intensively tested. Special attention was given to the following features: wide range of application, easy operation utilizing dialog programming, independent long time operation from mains and built in battery, modular concept, and integrated mass data store. Author (ESA)

N82-23993# Ott (A.) G.m.b.H., Kempten (West Germany).
DEVELOPMENT OF A DATA LOGGING AND TRANSMISSION UNIT Final Report
Reinhard Vogg and Wolfgang Wiedemann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1981 89 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-215; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18,70

A cheap data logging and transmission processor, Allgomatic OM 1802, was developed. A technical description of the processor, its hardware and software system is presented. Hardware and software were executed, considering the special operating conditions in environment measuring engineering. The system can be used for self-supporting data collection for a limited number of measuring data in hydrological and meteorological stations. This unit is a data collection device with an intersection for long distance transmission of the collected data to a superior central station. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N82-23994# Michigan Univ., Ann Arbor.
THE SOFTWARE DEVELOPMENT FACILITY APPROACH TO IMPROVED SOFTWARE DEVELOPMENT Ph.D. Thesis
David Walter Johnson 1981 231 p
Avail: Univ. Microfilms Order No. 8125141

An approach to the solution of problems in the development of software to meet data and information processing needs is presented. The software development facility (SDF) approach involves the integration of software tools into an easy to use decision support system. A descriptive model of a software system and the various environments in which such a software system could operate is provided. This model provides the motivation and foundation for the design of a generalized SDF which can be adapted to differing organizational and development support environments. The adaptability is accomplished by the use of a 'meta' definition function which allows an organization to describe software objects and relationships between objects of particular interest. A tool control function which integrates the various tools used in the development process is included. All pertinant data about the development process is maintained by a data base management function. The major usage functions include design, reporting, construction, testing, and management support. All user interaction with the SDF is via a user-friendly command language. A prototype develpment facility and its use on a specific software project are described. Results from the project show a substantial reduction in the manpower required when using the software development facility. Dissert. Abstr.

N82-23995# Utah Univ., Salt Lake City.
RESOURCE CONTROL IN A DEMAND-DRIVEN DATA-FLOW MODEL Ph.D. Thesis
Bharadwaj Jayaraman 1981 159 p
Avail: Univ. Microfilms Order No. 8127520

Some practical and theoretical aspects of resource control in one particular class of data-flow models are examined. The execution model is based on a demand-driven principle, and the high level programming language is based on the concept of 'function graphs'. The main emphasis is on a reliable, efficient, and flexible approach to defining shared data objects and synchronization of the processes that use them. It is shown that a demand-driven model of execution provides many computational advantages for designing primatives for synchronization. In keeping with the applicative style, an expression-based language, called resource expressions, is introduced, so that properties of synchronization, such as mutual exclusion, priority, etc., may be specified in a high level form. The formal semantics of this language are based on the concept of 'execution grapns'. The translation of resource expressions into the primitives for implementation and its correctness proof are presented. Using the specifications in this abstract implementation, an actual implementation in terms of the primitive operators is subsequently derived. Dissert. Abstr.

N82-23996# Washington Univ., Seattle.
SOME DESIGN AND ANALYSIS PROBLEMS FOR PARALLEL PROCESSING Ph.D. Thesis
Hung-Chang David Du 1981 143 p
Avail: Univ. Microfilms Order No. 8126096

Three software design problems generated by parallel processing architectures are considered. Two allocation methods for Cartesian product files effective for partial match queiries are proposed. Several organizations are investigated covering the spectrum from total independence to cooperation as in MIMD architectures. A simple model for a multiprocessor system are presented. In this model a set of non-uniformly distributed probabilities p(i) is employed to illustrate the program behavior, but no distinction is made between processors. Dissert. Abstr.

N82-23997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOFTWARE ENGINEERING LABORATORY (SEL) COMPENDIUM OF TOOLS, REVISION 1
Feb. 1982 77 p refs
(NASA-TM-84142; NAS 1.15:84142; SEL-81-107) Avail: NTIS HC A05/MF A01 CSCL 09B

A set of programs used to aid software product development is listed. Known as software tools, such programs include requirements analyzers, design languages, precompilers, code auditors, code analyzers, and software librarians. Abstracts, resource requirements, documentation, processing summaries, and availability are indicated for most tools. N.W.

N82-23998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GUIDE TO DATA COLLECTION
Sep. 1981 121 p
(NASA-TM-84181; NAS 1.15:84181; SEL-81-001) Avail: NTIS HC A06/MF A01 CSCL 09B

Guidelines and recommendations are presented for the collection of software development data. Motivation and planning for, and implementation and management of, a data collection effort are discussed. Topics covered include types, sources, and availability of data; methods and costs of data collection; types of analyses supported; and warnings and suggestions based on software engineering laboratory (SEL) experiences. This document is intended as a practical guide for software managers and engineers, abstracted and generalized from 5 years of SEL data collection. Author

N82-23999*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN APPRAISAL OF SELECTED COST/RESOURCE ESTIMATION MODELS FOR SOFTWARE SYSTEMS

J. F. Cook Dec. 1980 42 p refs

(NASA-TM-84179; NAS 1.15:84179; SEL-80-007) Avail: NTIS HC A03/MF A01

Several software cost/resource estimation models were applied to historical data of the Software Engineering Laboratory Data Base to appraise their applicability to the Flight Dynamics area. The models are designed to produce cost/resource estimates of software systems given several estimated parameters. No attempt was made to determine how the estimation equations were derived. The models were applied as presented. Author

N82-24000*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCEEDINGS FROM THE FIFTH ANNUAL SOFTWARE ENGINEERING WORKSHOP

1980 243 p refs Workshop held at Greenbelt, Md., 24 Nov. 1980

(NASA-TM-84188; NAS 1.15:84188) Avail: NTIS HC A11/MF A01 CSCL 09B

Methods of software design and development, software cost estimation, measuring software reliability, and measuring the software development process are considered. For individual titles, see N82-24001 through N82-24007.

N82-24001*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SOFTWARE ENGINEERING LABORATORY: AN APPROACH TO MEASURING SOFTWARE TECHNOLOGY

F. McGarry *In its* Proc. from the Fifth Ann. Software Eng. Workshop 1980 15 p (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

The investigations of the software evaluation laboratory into the software development process at NASA/Goddard are described. A data collection process for acquiring detailed histories of software development projects is outlined. The application of different sets of software methodologies to specific applications projects is summarized. The effect of the development methodology on productivity is discussed. J.D.

N82-24002*# Xerox Corp., Rochester, N. Y.

SOFTWARE COST/RESOURCE MODELING

John R. Golden, James R. Mueller, and Barbara Anselm *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 6 p refs (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

The Putnam method for planning the time/work effort component of software development is evaluated. This software costing model, based on Norden-Rayleigh product life cycle concepts, was applied to four development projects. The time/effort tradeoff leading to savings attainable when development time on a project is extended by a few months is demonstrated. The software equation which relates the principal parameters of development time, total effort, system size, and the development environment is presented. J.D.

N82-24003*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SOFTWARE COST/RESOURCE MODELING: DEEP SPACE NETWORK SOFTWARE COST ESTIMATION MODEL

Robert J. Tausworthe *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 46 p refs (For primary document see N82-24000 14-61)

(Contract NAS7-100)

Avail: NTIS HC A03/MF A01 CSCL 09B

A parametric software cost estimation model prepared for JPL deep space network (DSN) data systems implementation tasks is presented. The resource estimation model incorporates principles and data from a number of existing models, such as those of the General Research Corporation, Doty Associates, IBM (Walston-Felix), Rome Air Force Development Center, University of Maryland, and Rayleigh-Norden-Putnam. The model calibrates task magnitude and difficulty, development environment, and software technology effects through prompted responses to a set of approximately 50 questions. Parameters in the model are adjusted to fit JPL software lifecycle statistics. The estimation model output scales a standard DSN work breakdown structure skeleton, which is then input to a PERT/CPM system, producing a detailed schedule and resource budget for the project being planned. Author

N82-24004*# Boeing Aerospace Co., Seattle, Wash.

SOFTWARE COST/RESOURCE MODELING: SOFTWARE QUALITY TRADEOFF MEASUREMENT

R. W. Lawler *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 13 p (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

A conceptual framework for treating software quality from a total system perspective is developed. Examples are given to show how system quality objectives may be allocated to hardware and software; to illustrate trades among quality factors, both hardware and software, to achieve system performance objectives; and to illustrate the impact of certain design choices on software functionality. J.D.

N82-24005*# TRW, Inc., Redondo Beach, Calif.

SOFTWARE RELIABILITY: APPLICATION OF A RELIABILITY MODEL TO REQUIREMENTS ERROR ANALYSIS

J. Logan *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 3 p (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

The application of a software reliability model having a well defined correspondence of computer program properties to requirements error analysis is described. Requirements error categories which can be related to program structural elements are identified and their effect on program execution considered. The model is applied to a hypothetical B-5 requirement specification for a program module. J.D.

N82-24006*# Columbia Research Corp., Arlington, Va.

SOFTWARE RELIABILITY: A COMPARISON OF RESULTS OBTAINED FROM ESTABLISHED SOFTWARE RELIABILITY MODELS

Martin H. Horn and William E. Thompson *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 25 p refs (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

Two models of the software error detection process are compared, the Jelinski-Moranda model and a Bayes inference model. Simulation techniques are used to generate software related system failure data which is analyzed by both models. Point estimates and confidence limits are compared. It is demonstrated that uncertainty may be considerable for reasonable samples sizes and should be considered in any application of these techniques. The Jelinski-Moranda model is sensitive to the failure of data to follow internal assumptions of the model, often not providing any point estimates, a factor which may limit its usefulness in many real world situations. The Bayes model is shown to respond to the introduction of additional errors in the software correction process, a condition where error counting models such as the Jelinski-Moranda generally fail to converge. J.D.

N82-24007*# Logicon, Inc., Torrance, Calif.

MEASURING THE DEVELOPMENT PROCESS: A TOOL FOR SOFTWARE DESIGN EVALUATION

Susan S. Moy *In* NASA. Goddard Space Flight Center Proc. from the Fifth Ann. Software Eng. Workshop 1980 21 p refs (For primary document see N82-24000 14-61)

Avail: NTIS HC A11/MF A01 CSCL 09B

The design metrics evaluator (DME), a component of an automated software design analysis system, is described. The DME quantitatively evaluates software design attributes. Its use directs attention to areas of a procedure, module, or complete program having a high potential for error. J.D.

N82-24008# General Electric Co., Philadelphia, Pa. Space Div.

PROCEEDINGS OF THE SPACE SYSTEMS DIVISION REQUIREMENTS LANGUAGE WORKSHOP
C. L. Bittner 23 Mar. 1982 176 p Workshop held in Philadelphia, 23 Mar. 1982 2 Vol.
(Doc-82SDS010) Avail: NTIS HC A09/MF A01

Viewgraphs used in conference presentations are included. Subjects discussed include: common problems in systems engineering in a large software development project, microprocessor development in embedded systems, and other space systems development language concerns. S.L.

N82-24009# General Electric Co., Philadelphia, Pa. Space Div.
PROCEEDINGS OF THE SPACE SYSTEMS DIVISION REQUIREMENTS LANGUAGE WORKSHOP, APPENDIX A
C. L. Bittner 23 Mar. 1982 286 p refs Workshop held in Philadelphia, 23 Mar. 1982 2 Vol.
(Doc-82SDS010-App-A) Avail: NTIS HC A13/MF A01

Conference handouts are presented. Subjects included are: computer generated specifications, software requirements engineering methodology for real time system, and use of a formal language for the specification of computer programs. S.L.

N82-24010*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE SIXTH ANNUAL SOFTWARE ENGINEERING WORKSHOP
1981 277 p refs Conf. held in Greenbelt, Md., 2 Dec. 1981 (NASA-TM-84189; NAS 1.15:84189) Avail: NTIS HC A13/MF A01 CSCL 09B

Software development characteristics, models, and methodologies were presented and discussed. 0 For individual titles, see N82-24011 through N82-24021.

N82-24011*# Naval Research Lab., Washington, D. C.
EVALUATING SOFTWARE DEVELOPMENT CHARACTERISTICS: A COMPARISON OF SOFTWARE ERRORS IN DIFFERENT ENVIRONMENTS
David M. Weiss *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 25 p refs (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

Error data obtained from two different software development environments are compared. To obtain data that was complete, accurate, and meaningful, a goal-directed data collection methodology was used. Changes made to software were monitored concurrently with its development. Similarities common to both environments are included: (1) the principal error was in the design and implementation of single routines; (2) few errors were the result of changes, required more than one attempt to correct, and resulted in other errors; (3) relatively few errors took more than a day to correct. N.W.

N82-24012*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHODOLOGY EVALUATION: EFFECTS OF INDEPENDENT VERIFICATION AND INTERGRATION ON ONE CLASS OF APPLICATION
Jerry Page *In its* Proc. of the Sixth Ann. Software Eng. Workshop 1981 47 p (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

The effects of an independent verification and integration (V and I) methodology on one class of application are described. Resource profiles are discussed. The development environment is reviewed. Seven measures are presented to test the hypothesis that V and I improve the development and product. The V and I methodology provided: (1) a decrease in requirements ambiguities and misinterpretation; (2) no decrease in design errors; (3) no decrease in the cost of correcting errors; (4) a decrease in the cost of system and acceptance testing; (5) an increase in early discovery of errors; (6) no improvement in the quality of software put into operation; and (7) a decrease in productivity and an increase in cost. N.W.

N82-24013*# Maryland Univ., College Park.
EVALUATING SOFTWARE DEVELOPMENT CHARACTERISTICS: ASSESSMENT OF SOFTWARE MEASURES IN THE SOFTWARE ENGINEERING LABORATORY
Victor R. Basili *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 24 p refs (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

Work on metrics is discussed. Factors that affect software quality are reviewed. Metrics are discussed in terms of criteria achievements, reliability, and fault tolerance. Subjective and objective metrics are distinguished. Product/process and cost/quality metrics are characterized and discussed. N.W.

N82-24014*# International Business Machines Corp., Manassas, Va. Federal Systems Div.
SOFTWARE METRICS: THE QUANTITATIVE IMPACT OF FOUR FACTORS ON WORK RATES EXPERIENCED DURING SOFTWARE DEVELOPMENT
John E. Gaffney, Jr. and Robert W. Judge *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 15 p refs (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

A model of a software development process is described. The software development process is seen to consist of a sequence of activities, such as 'program design' and 'module development' (or coding). A manpower estimate is made by multiplying code size by the rates (man months per thousand lines of code) for each of the activities relevant to the particular case of interest and summing up the results. The effect of four objectively determinable factors (organization, software product type, computer type, and code type) on productivity values for each of nine principal software development activities was assessed. Four factors were identified which account for 39% of the observed productivity variation. Author

N82-24015*# Boeing Aerospace Co., Seattle, Wash.
SOFTWARE METRICS: SOFTWARE QUALITY METRICS FOR DISTRIBUTED SYSTEMS
Jonathan V. Post *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 15 p refs (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

Software quality metrics was extended to cover distributed computer systems. Emphasis is placed on studying embedded computer systems and on viewing them within a system life cycle. The hierarchy of quality factors, criteria, and metrics was maintained. New software quality factors were added, including survivability, expandability, and evolvability. N.W.

N82-24016*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IDENTIFICATION AND EVALUATION OF SOFTWARE MEASURES
David N. Card *In its* Proc. of the Sixth Ann. Software Eng. Workshop 1981 28 p refs (For primary document see N82-24010 14-61)
Avail: NTIS HC A13/MF A01 CSCL 09B

A large scale, systematic procedure for identifying and evaluating measures that meaningfully characterize one or more elements of software development is described. The background of this research, the nature of the data involved, and the steps of the analytic procedure are discussed. An example of the application of this procedure to data from real software development projects is presented. As the term is used here, a measure is a count or numerical rating of the occurrence of some property. Examples of measures include lines of code, number of computer runs, person hours expended, and degree of use of top down design methodology. Measures appeal to the researcher and the manager as a potential means of defining, explaining, and predicting software development qualities, especially productivity and reliability. S.L.

N82-24017*# City Univ., London (England).
SOFTWARE MODELS: A BAYESIAN APPROACH TO PARAMETER ESTIMATION IN THE JELENSKI-MORANDA SOFTWARE RELIABILITY MODEL
Bev Littlewood and Ariela Sofer (George Washington Univ.) *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 14 p (For primary document see N82-24010 14-61)

Avail: NTIS HC A13/MF A01 CSCL 09B

Maximum likelihood estimation procedures for the Jelinski-Moranda software reliability model often give misleading answers. A reparameterization and a Bayesian analysis eliminate some of the problems incurred by MLE methods and often give better predictions on sets of real and simulated data. Practical difficulties in estimating the initial number of errors N and the failure rate of each error phi by the method of maximum likelihood are: N, the MLE of N, is occasionally infinite (i.e., the routines for calculating N and phi do not converge). It is shown that N is finite sub i only if the regression line of the interevent times t sub i vs. i has positive slope. A serious problem is that often N approximates n, the sample size, and sometimes N = n. Thus the MLE predicts that the program is perfect even when it is far from being so. Only when almost all failures have been removed can N and phi be trusted near the end of debugging. S.L.

N82-24018*# Advanced Systems Technology Corp., Greenbelt, Md.

THE PROBLEM OF RESONANCE IN TECHNOLOGY USAGE

Hasan H. Sayani and Cyril P. Svoboda *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 18 p (For primary document see N82-24010 14-61)

Avail: NTIS HC A13/MF A01 CSCL 09B

Various information system tools and techniques are analyzed. A case study is presented which draws together the issues raised in three distinct cases. This case study shows a typical progression from the selection of an analysis methodology, to the adoption of an automated tool for specification and documentation, and the difficulty of fitting these into an existing life cycle development methodology. S.L.

N82-24019*# International Business Machines Corp., Manassas, Va.

CLEANROOM SOFTWARE DEVELOPMENT

M. Dyer and H. D. Mills *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 10 p (For primary document see N82-24010 14-61)

Avail: NTIS HC A13/MF A01 CSCL 09B

The 'cleanroom' software development process is a technical and organizational approach to developing software with certifiable reliability. Key ideas behind the process are well structured software specifications, randomized testing methods and the introduction of statistical controls; but the main point is to deny entry for defects during the development of software. This latter point suggests the use of the term 'cleanroom' in analogy to the defect prevention controls used in the manufacturing of high technology hardware. In the 'cleanroom', the entire software development process is embedded within a formal statistical design, in contrast to executing selected tests and appealing to the randomness of operational settings for drawing statistical inferences. Instead, random testing is introduced as a part of the statistical design itself so that when development and testing are completed, statistical inferences are made about the operation of the system. S.L.

N82-24020*# Hughes Aircraft Co., Fullerton, Calif. Software Engineering Div.

SELECTING A SOFTWARE DEVELOPMENT METHODOLOGY

Robert E. Jones *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 14 p (For primary document see N82-24010 14-61)

Avail: NTIS HC A13/MF A01 CSCL 09B

The state of the art analytical techniques for the development and verification of digital flight control software is studied and a practical designer oriented development and verification methodology is produced. The effectiveness of the analytic techniques chosen for the development and verification methodology are assessed both technically and financially. Technical assessments analyze the error preventing and detecting capabilities of the chosen technique in all of the pertinent software development phases. Financial assessments describe the cost impact of using the techniques, specifically, the cost of implementing and applying the techniques as well as the relizable cost savings. Both the technical and financial assessment are quantitative where possible. In the case of techniques which cannot be quantitatively assessed, qualitative judgements are expressed about the effectiveness and cost of the techniques. The reasons why quantitative assessments are not possible will be documented. S.L.

N82-24021*# Bell Telephone Labs., Inc., Holmdel, N. J.

DEVELOPMENT TECHNIQUES FOR GENERIC SOFTWARE

Richard L. Hamilton *In* NASA. Goddard Space Flight Center Proc. of the Sixth Ann. Software Eng. Workshop 1981 20 p refs (For primary document see N82-24010 14-61)

Avail: NTIS HC A13/MF A01 CSCL 09B

In developing the first version of a generic implementation of X.25, Levels 2 and 3, three development techniques are examined: table driven finite state machine implementation, an integrated testing environment, and top down design. A finite state machine (FSM) is a powerful tool for both specifying and implementing protocols. This technique was used in the X.25 specification. A table driven implementation of the FSM was chosen to facilitate changes and simplify coding. The effect that this technique have on program size, speed of execution, coding time, and debugging time are investigated. S.L.

N82-24022# Computer Sciences Corp., Falls Church, Va.

ADA INTEGRATED ENVIRONMENT 2 COMPUTER PROGRAM DEVELOPMENT SPECIFICATION, PART 1 Interim Report, 15 Sep. 1980 - 15 Mar. 1981

Griffiss AFB, N.Y. RADC Dec. 1981 315 p (Contract F30602-80-C-0292; AF Proj. 5581) (AD-A109980; RADC-TR-81-364-Pt-1) Avail: NTIS HC A14/MF A01 CSCL 09/2

The Ada Integrated Environment (AIE) consists of a set of software tools intended to support design, development and maintenance of embedded computer software. A significant portion of an AIE includes software systems and tools residing and executing on a host computer (or set of computers). This set is known as an Ada Programming Support Environment (APSE). This B-5 Specification describes, in detail, the design for a minimal APSE, called a MAPSE. GRA

N82-24023# Computer Sciences Corp., Falls Church, Va.

ADA INTEGRATED ENVIRONMENT 2 COMPUTER PROGRAM DEVELOPMENT SPECIFICATION, PART 2 Interim Report, 15 Sep. 1980 - 15 Mar. 1981

Griffiss AFB, N.Y. RADC Dec. 1981 447 p (Contract F30602-80-C-0292; AF Proj. 5581) (AD-A109981; RADC-TR-81-364-Pt-2) Avail: NTIS HC A19/MF A01 CSCL 09/2

Software tools comprising the minimal Ada programming support environment are described including the Ada compiler, linker/loader, debugger, editor, and configuration management tools. The software tools are intended to support design, development, and maintenance of embedded computer software. M.G.

N82-24024# European Organization for Nuclear Research, Geneva (Switzerland).

FORTRAN PROGRAM OPTIMIZATION

Michael Metcalf 22 Sep. 1980 47 p refs (CERN-80-08) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

Techniques are outlined which indicate how FORTRAN programs may be optimized, particularly on large CDC and IBM systems, whose compilers and CPU's are briefly described. DOE

N82-24025# Research Inst. of National Defence, Linkoeping (Sweden).

STOCHASTIC LABELING THEORY: PRACTICE AND COMPUTER PROGRAMMING [STOKASTISK ETIKETTERING: TEORI, EXPERIMENT OCH PROGRAMVARA]

B. Andersson, J.-O. Eklundh, T. Elfving, and P. Vaerbrand Dec. 1981 77 p refs Partly in SWEDISH and ENGLISH (FOA-C-30256-E1) Avail: NTIS HC A05/MF A01

The stochastic relaxation method in its application to the automatic classification of images or parts of images is reviewed and the theory of the method is outlined. A relaxation model for edge detection in aerial photography is discussed. A computer

program was developed for this problem. The behavior of error calculation and the ratio charts between experimental and theoretical rate of convergence for triangle labeling are presented. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N82-24026 Royal Signals and Radar Establishment, Malvern (England).
PROVIDING AN X25 INTERFACE TO THE ROYAL SIGNALS AND RADAR ESTABLISHMENT PILOT PACKET SWITCHED NETWORK
R. T. Edwards Aug. 1981 18 p refs
(RSRE-Memo-3402; BR82084) Copyright. Avail: Issuing Activity

The X25 protocol is assessed for its suitability as an interface to the pilot packet switched network (PPSN) and as an interface to military networks in general. The technique used to integrate the protocol into the network is described. The PPSN access nodes provide an end to end virtual call and datagram service across a datagram switching subnetwork, via a transnetwork protocol. A separately defined end to end protocol, operating above the transnetwork protocol, caters for negotiation at call setup, reset, and interrupt. A host support package, operating in an access node, translates from the X25 access protocol to the network internal protocols. The PSSN virtual call flow control operates as a token scheme. The full X25 window is accomodated at call establishment and after a reset. Multi-addressing is achieved on virtual calls by creating a multi-address data packet. Author (ESA)

N82-24027# General Accounting Office, Washington, D. C.
GOVERNMENT-WIDE GUIDELINES AND MANAGEMENT ASSISTANCE CENTER NEEDED TO IMPROVE ADP SYSTEMS DEVELOPMENT
20 Feb. 1981 25 p
(AFMD-81-20; B-201441) Avail: NTIS HC A02/MF A01; also available from General Accounting Office, Document Handling and Information Services Facility

A structured management approach to Federal ADP systems development is recommended. The development of guidelines and a center to assist Federal agency management in planning, designing, acquiring, and evalating large, complex ADP systems development projects are advised. N.W.

N82-24028# Fondazione Ugo Bordoni, Rome (Italy).
COST 201: STANDBY NETWORK OPTIMIZATION MODULE (SBO). PART 1: NETWORK MODELING AND SOLUTION TECHNIQUES
Ugo Mocci Oct. 1981 46 p refs
(FUB-19-1981-Pt-1) Avail: NTIS HC A03/MF A01

The optimization of a standby protection network, fulfilling given rerouting requirements, is treated. Analysis of heuristic solutions elicits the basic algorithms required and indicates time saving computational techniques. The solution adopted combines PRIMAL (structured on the analogy of the sequential heuristic procedure used to dimension a network meeting a given requirement matrix in multicommodity flow problems) with DUAL (feasibility of the rerouting requirement of each failing edge is iteratively tested on the standby network). The DUAL method produces an initial assessment of the standby network which is used by PRIMAL to produce a feasible solution. A switch in the external loop of DUAL jumps to PRIMAL when it seems convenient. A feasibility test either stops the procedure (when feasibility is achieved) or gives information about bottlenecks. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N82-24029# Columbia Univ., New York.
APPROXIMATING QUEUES WITH SUPERPOSITION ARRIVAL PROCESSES Ph.D. Thesis
Susan Lee Albin 1981 307 p
Avail: Univ. Microfilms Order No. 8125234

Approximations were developed for the operating characteristics of queueing models with arrivals coming from several independent sources. The approximation developed combines two basic methods to form a hybrid that works significantly better than either of the basic methods alone. The procedure in the basic and hybrid methods is to approximate the complex superposition process by a single renewal process. Each method specifies a mean and a squared coefficient of variation for the intervals in this renewal process. The two basic methods agree on the mean of the approximating renewal intervals. The weighting function in the convex combination is identified using simulation together with analytical limiting properties of the basic methods. For approximations of the expected number in the system, the standard deviation of the number in the system and the probability a customer is delayed before entering service, different weighting functions are developed. Dissert. Abstr.

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N82-24030# California Univ., Berkeley.
CONVERGENCE PROPERTIES OF THE CONJUGATE GRADIENT ALGORITHM IN EXACT AND FINITE PRECISION ARITHMETIC Ph.D. Thesis
Anne Greenbaum 1981 95 p
Avail: Univ. Microfilms Order No. 8200121

The behavior of the conjugate gradient algorithm in exact and finite precision arithmetic is described. Sharp upper bounds are given for the error at each step of an exact arithmetic conjugate gradient solution of a symmetric, positive definite system of linear equations. It is shown that a finite precision computation maintains close agreement with its exact arithmetic counterpart until (and unless) it reaches a step at which some error component(s) have been reduced by a much greater factor than the overall reduction in the norm of the error. Subsequent steps of the finite precision computation may closely resemble the previous steps of an exact arithmetic conjugate gradient calculation from a different initial guess. This resemblance is maintained until other error components are greatly reduced, at which point subsequent steps may resemble still earlier steps of another exact arithmetic calculation. As long as this agreement with various exact arithmetic calculations is maintained, the appropriate exact arithmetic error bounds can be applied to a finite precision computation. Dissert. Abstr.

N82-24031# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ESTIMATION MODELS INVOLVING QUALITATIVE DEPENDENT VARIABLES [ESTIMACAO EM BODELOS ENVOLVENDO VARIAVEIS DEPENDENTES QUALITATIVAS]
Nivea Teixeira Dias and Nucio Roberto Dias Sep. 1981 22 p refs In PORTUGUESE; ENGLISH summary Presented at the 33rd Ann. Meeting of SBPC, Salvador, Brazil, 8-15 Jul. 1981
(INPR-2218-PRE/016) Avail: NTIS HC A02/MF A01

The statistical analysis of models with qualitative dependent variables is considered. Several methods for estimating the parameters of the Logit (or logistic) model for analysis of the behavior of discrete random variables are evaluated. A detailed description of the Logit model is presented and its application to specific situations considered. J.D.

N82-24032# Instituut TNO voor Wiskunde, Informatieverwerking en Statistiek, The Hague (Netherlands).
REPRESENTING ASSOCIATIONS BETWEEN ELEMENTS OF BEHAVIOR
J. A. Hoekstra and J. Reddingius (Rijksunsversiteit Groningen) Jan. 1981 28 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC A03/MF A01

Statistical techniques for analyzing transition matrices in ethology are discussed. Principle component analysis, principle coordinate analysis, and factor analysis are described and applied to specific problems in statistical ethology. The results of the application of these techniques are evaluated. J.D.

N82-24033# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro. Lab. d'Analyse Numerique.
MATHEMATICAL BASES OF THE FINITE ELEMENT METHOD [BASES MATHEMATIQUES DES METHODES D'ELEMENTS FINIS]
Jean-Marie Thomas Apr. 1980 21 p In FRENCH
(CBPF-A0012/80) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Applications to the second and third order elliptical problems and to the elasticity system are made, using the finite element method. DOE

N82-24034# Oak Ridge National Lab., Tenn. Physics Div.
TRANSFORMATION BETWEEN HARMONIC-OSCILLATOR WAVE FUNCTIONS IN DIFFERENT COORDINATE BASES
K. T. R. Davies and S. J. Krieger Oct. 1981 21 p refs
(Contract W-7405-eng-26)
(DE82-001967; ORNL/TM-8032) Avail: NTIS HC A02/MF A01

Coefficients are derived for transformations between harmonic oscillator wave functions in different coordinate representations. Such coefficients were found especially useful in performing static Hartree-Fock calculations for nuclei of widely varying shapes. DOE

N82-24035# Oxford Univ. (England). Dept. of Engineering Science.
NUMERICAL STABILITY OF FINITE ELEMENT SOLUTIONS APPLIED TO THE FREEZING OF BIOLOGICAL MATERIALS
W. B. Bald Sep. 1981 18 p refs
(OUEL-1377/81) Avail: NTIS HC A02/MF A01

The potential of the finite element method as an alternative to finite difference methods for solving the complex heat and mass diffusion problems which arise in cryobiology is assessed. The major difficulty in applying existing finite element computer packages to thermal phase change problems is the inclusion of the latent heat contribution to the energy balance. The enthalpy method, used successfully to solve phase change problems numerically, using finite differences, is an obvious method to apply to the finite element approach to the problem. The results of applying specific heat functions, representing the latent heat of fusion, to a typical biological freezing problem and the resulting mesh size and time interval required to achieve reasonably numerically stable solutions is discussed. The computer package used to obtain the solutions is cited. Author (ESA)

N82-24036# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
GLOBAL BOUNDEDNESS OF MOMENTS OF SOLUTIONS OF THE BOLTZMANN EQUATION FOR INFINITE RANGE FORCES
Tony Elmroth 1982 15 p refs
(CTH-Math-1982-2) Avail: NTIS HC A02/MF A01

The global boundedness in time of higher moments to a weak solution of the nonlinear space-homogeneous Boltzmann equation for infinite range inverse k power forces with $k > or = 5$ is proven. In the course of the proof a collisional estimate of (v prime sup s) + (v prime (*) sup s) - (v sup s) - (v * sup s) is obtained, where v, v* are the initial velocities before and v prime, v prime (*) are the velocities after a binary collision. Author (ESA)

N82-24037# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
POLO2: A USER'S GUIDE TO MULTIPLE PROBIT OR LOGIT ANALYSIS Final Report
Robert M. Russell, N. E. Savin, and Jacqueline L. Robertson Sep. 1981 44 p refs
(PB82-134487; FSGTR/PSW-55) Avail: NTIS HC A03/MF A01 CSCL 12A

A guide providing instructions for the use of POLO2, a computer program for multivariate probit or logit analysis of quantal response data is presented. As many as 3000 test subjects may be included in a single analysis. Including the constant term, up to nine explanatory variables may be used. Examples illustrating input, output, and uses of the program's special features for hypothesis testing are included. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N82-24038# Texas Univ. at Dallas.
AN APPLICATION OF THE SINGULAR VALUE DECOMPOSITION TO LINEAR FEATURE SELECTION Ph.D. Thesis
Dean Max Young 1981 124 p
Avail: Univ. Microfilms Order No. 8126596

A methodology of dimension reduction for m populations pi sub 1, pi sub 2.....pi sub m with normally distributed measurement vectors is proposed. The method is founded upon the singular value decomposition of a real matrix which is a sufficient statistic for the dimension reduction problem. This method is compared to four currently used methods in a Monte Carlo simulation. Three feature subset selection methods are developed and then compared with seven methods in two well-known statistical packages. Finally, the new linear feature selection methodology is extended to the m population case where the measurement vectors on an individual from each population belong to a general class of normed exponential densities. Dissert. Abstr.

N82-24039# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
WEAK CONVERGENCE OF A BAYESIAN NONPARAMETRIC ESTIMATOR OF THE SURVIVAL FUNCTION UNDER PROGRESSIVE CENSORING
Joseph C. Gardiner and V. Susarla (New York State Univ., Binghamton) Feb. 1982 15 p refs
(Contract N00014-79-C-0522; Grants NIH-IR01-GM28030; NIH-IR01-GM28405)
(AD-A111858) Avail: NTIS HC A02/MF A01 CSCL 12/1

A nonparametric Bayesian estimator F (circumflex) of the survival function F constructed from time-sequential progressively censored observations is found to subsume several estimators of F utilized in practice. Weak convergence of F (circumflex) is developed and the limiting process is found to coincide with that obtained when complete response profiles of the sample are available, leading to suitable application of F (circumflex) with consequent reductions in costs and time and without loss of asymptotic accuracy. Author (GRA)

N82-24040# Rice Univ., Houston, Tex.
THE CONSTRUCTION OF ALGORITHMS FOR THE EFFICIENT ESTIMATION OF MULTIVARIATE PROBABILITY DENSITIES Final Report, Jun. 1978 - Oct. 1981
James R. Thompson 20 Jan. 1982 6 p refs
(Contract DAAG29-79-C-0180; Grant DAAG29-78-G-0187)
(AD-A110766; ARO-15637.12-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Techniques have been proposed for estimating probability densities nonparmetrically. These include penalized maximum likelihood, series, fixed kernel and nearest neighbour procedures. Special attention was to the two and three dimensional cases. A databased random number generator for arbitrarily high dimensions was also developed and applied to ballistics data at Aberdeen Proving Ground. A number of biomedical applications were proposed for the related problem of the nonparametric estimation of intervals using cancer data. Author (GRA)

N82-24041# Rockwell International Science Center, Thousand Oaks, Calif.
RESEARCH IN STATISTICAL ASSURANCE METHODS Final Report, 1 Jul. 1980 - 31 Oct. 1981
N. R. Mann Feb. 1982 5 p
(Contract N0014-80-C-0684; NR Proj. 047-204)
(AD-A111213; SC5278.1FR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two papers describing research dealing with the analysis of reliability data were written during the past year and are to be published. Another has been written and submitted for publication, two others were revised for publication, and another was published. Several invited presentations were made at scientific meetings. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N82-24042# Research Inst. of National Defence, Linkoeping (Sweden).
BINARY SEQUENCES WITH AUTOCORRELATIONS AND CROSS CORRELATIONS IN A PRESCRIBED RANGE
Eva Edberg Jan. 1982 25 p refs
(FOA-C-30255-E2) Avail: NTIS HC A02/MF A01

Sequences are surveyed with the property that when a sequence of length n is compared to the same sequence cyclically shifted any number of steps, except for a multiple of the length n, the number of positions where they differ is always $(n+1)/2$. A method for constructing sets of binary sequences with the property that the autocorrelations and the cross correlations of all sequences within a set fall within a prescribed range is devised. The lengths of the sequences are restricted to 500 to 1200 binary digits. Test cases are presented and comparisons are made with sets of sequences that were chosen at random, showing good results. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N82-24043# California Univ., Berkeley.
ON POINT MAPPING METHODS FOR STUDYING NONLINEAR DYNAMICAL SYSTEMS Ph.D. Thesis
Ramesh Subba Rao Guttalu 1981 155 p
Avail: Univ. Microfilms Order No. 8200125

The global behavior of nonlinear dynamical systems described by periodic differential equations and difference equations was studied in a systematic manner. The analysis of dynamical systems by point mapping methods is demonstrated. An exact point mapping (or Poincare' map) of a simple mechanical system of one degree of freedom system subjected to a periodic support motion (a saw-tooth function) is obtained analytically. The global stability regions of asymptotically stable periodic solutions are also obtained. They indicate that even though the dynamical system is a simple one, it has a very complex global behavior. A method of global analysis referred to as the cell mapping technique was developed motivated by the facts that physical measurements are made to a certain precision only and that round-off errors are incurred in computations. Essentially, a cell mapping can be realized by discretizing the state variables and the method is equally applicable to both differential and difference dynamical systems. A global analysis algorithm of cell mappings effectively determines the equilibrium states, periodic states and their domains of attraction all at once. The development of a computational algorithm for determining the topological degree of a map is also discussed. Dissert. Abstr.

N82-24044# National Physical Lab., Teddington (England). Div. of Electrical Science.
SYSTEM OF COILS FOR UNIFORM FLUX DENSITY
P. Vigoureux Jan. 1982 17 p refs
(NPL-DES-67; ISSN-0143-7305) Copyright. Avail: NTIS HC A02/MF A01

The configuration of a system of coils for measuring the gyromagnetic ratio of the proton was analyzed. Normalized formulas, applicable to a system of any diameter, were worked out for windings of negligible cross section; the changes in shape required by the finite cross section were calculated. A method using Ampere's law for measuring the flux density at the center of a solenoid was examined. The travel of the measuring instrument (squid probe) is too large for use with the system. The magnetic field produced over a sphere of 40 mm dia is uniform to 3 in 10 to the eighth power. Author (ESA)

N82-24045# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
MAGNETIC BRAKING AND ANGULAR MOMENTUM TRANSPORT
L. Mestel (Sussex Univ., England) and R. B. Paris Jul. 1980 67 p refs
(EUR-CEA-FC-1049) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

The redistribution of angular momentum in a non-uniformly rotating plasma, permeated by a larger scale frozen-in magnetic field and symmetric about the rotation axis, was investigated analyatically. Due to the twisting of the poloidal magnetic field lines arising from the non-uniform rotation, magnetic torques are exerted on the plasma which try to suppress the rotational shear. There is a consequent transport of angular momentum, via torsional Alfven waves propagating along the magnetic field lines, from the more rapidly to the more slowly rotating parts of the plasma. A spherical, uniformly dense central core of plasma, or blob, of fixed radius is imagined to be rotating differentially with respect to the surrounding medium, and initially the blob and its environs are given uniform angular velocities (LAMBDA) and (LAMBDA)0 respectively. Two models of the frozen-in poloidal magnetic field linking the blob to its surroundings are considered. The equations describing the interaction between the magnetic and rotation fields were solved by Laplace transformation techniques.

N82-24046# Association Euratom-CEA, Grenoble (France). Dept. de Recherches sur la Fusion Controlee.
FILAMENTATION AND COLLAPSE OF LANGMUIR WAVES IN A WEAK MAGNETIC FIELD
P. Rolland and S. G. Tagare (Hyderabad Univ., India) Dec. 1980 39 p refs
(EUR-CEA-FC-1074) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The filamentation and collapse of Langmuir waves in a weak magnetic field are analyzed in two particular cases of low-frequency acoustic perturbations: (1) adiabatic perturbations which correspond to subsonic collapse, and (2) non-adiabatic perturbations which correspond to supersonic collapse. Here the existence of Langmuir filaments and Langmuir collapse in a weak magnetic field are due to nonlinear interaction of high-frequency Langmuir waves (which make small angle with the external magnetic field) with low-frequency acoustic perturbations along the magnetic field. DOE

N82-24047# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.
THE FIELD INDUCED IN A CONDUCTING SPHERE PLACED IN A STEADY MAGNETIC FIELD AND A PERPENDICULAR OSCILLATORY MAGNETIC FIELD
Waheed N. Hugrass Mar. 1981 21 p refs Sponsored in part by Australia Dept. of National Development and Energy

(FUPH-R-173) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The fields induced in a conducting sphere of conductivity eta, placed in a strong steady magnetic field B sub (a) z, and a small oscillatory magnetic field (in the XY plane) of magnitude B sub omega were calculated approximately for: B sub omega/B sub (a) $<<$ 1 and B sub (a)/ne(eta) $<<$ 1, where n is the number density. The conducting sphere is assumed to have a uniform resistivity and number density and the ions are assumed immobile. It was shown that: (1) if the applied oscillatory field is linearly polarized, the magnetic field induced in the conducting sphere has a rotating component for which omega (vector) is parallel to B sub (a) z; (2) if the applied oscillatory field is rotating (circularly polarized), its penetration in the conducting sphere is enhanced or impeded with respect to the classical skin effect depending on whether the sense of rotation is parallel or antiparallel to B sub (a) z. These results are consistent with the experimental observation in the rotating field plasma experiments. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N82-24048# Old Dominion Univ., Norfolk, Va.

SOUND ABSORPTION IN N2-H2O GAS MIXTURES AT ROOM TEMPERATURE AND LOW FREQUENCY/PRESSURE RATIOS Ph.D. Thesis

William Axam Griffin 1981 136 p

Avail: Univ. Microfilms Order No. 8128307

Standard values of nitrogen's contribution to sound absorption in the Earth's atmosphere were investigated. The free decay technique was used in a resonance tube to obtain ten sets of sound absorption data in H2-H2O gas mixtures and requisite companion data in N2-CO2 and technical grade N2. All measurements were made at an ambient temperature of 297 K. A best-fit, linear relationship between the vibrational relaxation peak location and the humidity yields a correlation coefficient of 0.9938, an intercept of 0.013 + or - 0.012 Hz/atm, and a slope of (2.00 + or - 0.24) x 10,000 (Hz/atm)/mole fraction. A vibration-translation energy transfer model (VT) and a vibration-vibration energy transfer model (VV) were evaluated with respect to theory and experiment to ascertain the better model. From theoretical calculations, the VV transfer rate is seen to be 4 to 6 orders of magnitude faster than the VT rate. This result and the other evidence provide strong support for the V-V model; hence, it is preferred. Dissert. Abstr.

N82-24049# Notre Dame Univ., Ind.

SOUND GENERATED IN A CASCADE OF AIRFOILS BY THREE-DIMENSIONAL DISTURBANCES CONVECTED IN A SUBSONIC FLOW Ph.D. Thesis

Ghassan Mahmoud Fawzi Hamad 1981 203 p

Avail: Univ. Microfilms Order No. 8129280

In turbomachines, flow patterns are very complex and result in three-dimensional disturbances with swirling vortices at the inlet or a tip vortex and secondary flow interacting with a subsequent stage. The noise generated in a fan whose elements are subjected to three-dimensional disturbances was examined and the results were compared with the two-dimensional case. The theory used provides an exact solution to coupling between the vortical and acoustic waves. There is no need for Lighthill's analogy. It is shown that three-dimensional effects have significant influence on the sound intensity as well as cutoff condition of the system particularly at large spanwise wavenumber. The retarded time effect on the acoustic power was investigated as well as the relative importance of streamwise vortical disturbances as compared with the more traditional vorticity generated by wake defects. Dissert. Abstr.

N82-24050*# Boeing Vertol Co., Philadelphia, Pa.

AN INVESTIGATION OF ROTOR HARMONIC NOISE BY THE USE OF SMALL SCALE WIND TUNNEL MODELS Final Report

Harry Sternfeld, Jr. and Edward G. Schaffer Apr. 1982 100 p refs

(Contract NAS2-10767)

(NASA-CR-166337; NAS 1.26:166337) Avail: NTIS HC A05/MF A01 CSCL 20A

Noise measurements of small scale helicopter rotor models were compared with noise measurements of full scale helicopters to determine what information about the full scale helicopters could be derived from noise measurements of small scale helicopter models. Comparisons were made of the discrete frequency (rotational) noise for 4 pairs of tests. Areas covered were tip speed effects, isolated rotor, tandem rotor, and main rotor/tail rotor interaction. Results show good comparison of noise trends with configuration and test condition changes, and good comparison of absolute noise measurements with the corrections used except for the isolated rotor case. Noise measurements of the isolated rotor show a great deal of scatter reflecting the fact that the rotor in hover is basically unstable. Author

N82-24051*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GUIDE TO THE EVALUATION OF HUMAN EXPOSURE TO NOISE FROM LARGE WIND TURBINES

David G. Stephens, Kevin P. Shepherd (Bionetics Corp., Hampton, Va.), Harvey H. Hubbard (College of William and Mary, Newport News, Va.), and Ferdinand W. Grosveld (Bionetics Corp., Hampton, Va.) Mar. 1982 71 p refs

(Contract NAS1-14970; Grant NAG1-166)

(NASA-TM-83288; NAS 1.15:83288) Avail: NTIS HC A04/MF A01 CSCL 20A

Guidance for evaluating human exposure to wind turbine noise is provided and includes consideration of the source characteristics, the propagation to the receiver location, and the exposure of the receiver to the noise. The criteria for evaluation of human exposure are based on comparisons of the noise at the receiver location with the human perception thresholds for wind turbine noise and noise-induced building vibrations in the presence of background noise. B.W.

N82-24052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A STUDY OF RESONANT-CAVITY AND FIBERGLASS-FILLED PARALLEL BAFFLES AS DUCT SILENCERS

Paul T. Soderman Apr. 1982 68 p refs

(NASA-TP-1970; NAS 1.60:1970; AVRADCOM-TR-81-A-2)

Avail: NTIS HC A04/MF A01 CSCL 20A

Acoustical performance and pressure drop were measured for two types of splitters designed to attenuate sound propagating in ducts - resonant-cavity baffles and fiberglass-filled baffles. Arrays of four baffles were evaluated in the 7- by 10-foot wind tunnel number 1 at Ames Research Center at flow speeds from 0 to 41 m/sec. The baffles were 2.1 m high, 305 to 406 mm thick, and 3.1 to 4.4 m long. Emphasis was on measurements of silencer insertion loss as affected by variations of such parameters as baffle length, baffle thickness, perforated skin geometry, cavity size and shape, cavity damping, wind speed, and acoustic field directivity. An analytical method for predicting silencer performance is described and compared with measurements. With the addition of cavity damping in the form of 25-mm foam linings, the insertion loss above 250 Hz of the resonant-cavity baffles was improved 2 to 7 db compared with the undamped baffles; the loss became equal to or greater than the insertion loss of comparable size fiberglass baffles at frequencies above 250 Hz. Variations of cavity size and shape showed that a series of cavities with triangular cross-sections (i.e., variable depth) were superior to cavities with rectangular cross sections (i.e., constant depth). In wind, the undamped, resonant-cavity baffles generated loud cavity-resonance tones; the tones could be eliminated by cavity damping. B.W.

N82-24053# Atomic Energy Research Establishment, Harwell (England). Materials Physics Div.

LASER GENERATION OF ULTRASOUND IN METALS

C. B. Scruby, R. J. Dewhurst, D. A. Hutchins, and S. B. Palmer May 1981 72 p refs Prepared in cooperation with Hull Univ. sponsored in part by Dept. of Industry

(AERE-R-10099; HL81/1355(C14)) Avail: NTIS

HC A04/MF A01

Those features of laser generated ultrasound that make it different from conventional piezoelectric generation are identfied, so that suitable application areas can be explored. Some of the physical principles underlying the generation process are discussed. Experimental results that best demonstrate the characteristics of this novel ultrasonic source are presented. S.L.

N82-24054# Royal Aircraft Establishment, Farnborough (England).

FURTHER MEASUREMENTS OF THE ACOUSTIC PERFORMANCE OF A VARIANT OF THE MK 4 HELMET EARMUFF ASSEMBLY

M. K. Cogger, S. A. Wood, and Susan H. Lucas Nov. 1981 29 p refs

(RAE-TM-FS-441; BR81773) Copyright, Avail: Issuing Activity

Acoustic tests of the attenuation, frequency response and total harmonic distortion of experimental earmuff assemblies intended as alternatives to the B2 production shells fitted to the Mk 4 flight helmet are reported. The experimental earmuff (melamine shells with flanges) dough molded compound without flanges (Mk 4 alternative assemblies) and B2 production shells (Mk 4 helmet) were tested. Attenuation was calculated from insertion loss, i.e., the difference in db between the unoccluded and occluded spectra. Objective tests, using an artificial ear, and semiobjective tests, using 15 short haired, clean shaven subjects were performed. The A-weighted level of the sound field was 99 db(A), lasting for 15 min, the equivalent of 84 db(A) for 8 hr. The experimental earmuff is superior to the other designs. Author (ESA)

N82-24055# California Univ., Los Angeles. Dept. of Physics.

PROPAGATION OF SOUND IN MATTER Interim Summary Report, 1 Oct. 1968 - 1 Feb. 1982

Isadore Rudnick Mar. 1982 44 p refs

(Contracts N00014-67-A-0111-0019; N00014-69-A-0200-4014; N00014-75-C-0246)

(AD-A111842) Avail: NTIS HC A03/MF A01 CSCL 20/13

Liquid helium is discussed in relation to sound propagation in matter. Acoustic attenuation and size effects in liquid helium are investigated. Persistant currents in superfluid helium are also discussed. S.L.

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N82-24056# North Carolina State Univ. at Raleigh.

OBSERVATIONS OF COLLECTIVE ION ACCELERATION Ph.D. Thesis

David Lee Morrow 1981 127 p

Avail: Univ. Microfilms Order No. 8128539

Linear collective acceleration of protons by a relativistic electron beam (0.5 MeV, 50 kA, 60 ns) was explored in the vacuum diode and vacuum drift tube. Nylon meshes, polyethylene films and nylon filaments as proton sources were tested along with the variation of cathode-anode-target spacings. Target activation was used to compare the various arrangements and to yield information concerning proton energies, amounts, and spatial distributions. Proton energies in excess of 7 MeV (12 times the electron energy) were produced with filaments in 30 cm long drift tubes. A few times 10 billion particles were accelerated at this level. Activation was localized to a target spot and an axial streak on the drift tube wall. Electron beam behavior in the drift tube was examined with a Rogowski coil to measure the current and PIN diodes to measure bremsstrahlung. In addition, the periodic activation of dielectric cathodes by radially accelerated protons is reported. Dissert. Abstr.

N82-24057# California Univ., Berkeley.

ELECTRON COLLISIONAL DETACHMENT PROCESSES FOR A 250 keV D- ION BEAM IN A PARTIALLY IONIZED HYDROGEN TARGET Ph.D. Thesis

Stephen Edward Savas 1981 167 p

Avail: Univ. Microfilms Order No. 8200263

Neutral atom beams with energies above 200 keV are required for various purposes in magnetic fusion devices following TFTR, JET and MFTF-B. These beams are produced much more efficiently by electron detachment from negative ion beams than by electron capture by positive ions. The efficiency with which such neutral atoms can be produced by electron detachment in partially ionized hydrogen plasma neutralizers is investigated. Neutralization efficiencies for partially ionized hydrogen targets are calculated making use of cross sections. Previously calculated only for a pure electron gas neutralizer, this result was extended to conditions of arbitrary mixture of hydrogen gas and plasma using an averaging technique on the cross sections for the different target species. The effect of mixtures with contaminating gases and O2 and N2 on the neutralizer efficiency are also studied. Dissert. Abstr.

N82-24058# Oak Ridge National Lab., Tenn. Health and Safety Research Div.

RADIOACTIVE DECAY DATA TABLES: A HANDBOOK OF DECAY DATA FOR APPLICATION TO RADIATION DOSIMETRY AND RADIOLOGICAL ASSESSMENTS

David C. Kocher and Jean S. Smith, ed. 1981 227 p refs Sponsored by DOE

(DOE/TIC-11026) Copyright. Avail: NTIS HC $18.75

Decay data are presented for approximately 500 radionuclides including those occurring naturally in the environment, those of potential importance in routine or accidental releases from the nuclear fuel cycle, those of current interest in nuclear medicine and fusion reactor technology, and some of those of interest to Committee 2 of the International Commission on Radiological Protection for the estimation of annual limits on intake via inhalation and ingestion for occupationally exposed individuals. Physical processes involved in radioactive decay which produce the different types of radiation observed, methods used to prepare the decay data sets for each radionuclide in the format of the computerized evaluated nuclear structure data file, the tables of radioactive decay data, and the computer code MEDLIST used to produce the tables are described. Applications of the data to problems of interest in radiation dosimetry and radiological assessments are considered as well as the calculations of the activity of a daughter radionuclide relative to the activity of its parent in a radioactive decay chain. Dissert. Abstr.

N82-24059# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.

THE ACCELERATION OF MOLECULAR HYDROGEN CLOUDS THROUGH RADIATIVE DISSOCIATION

Martin Harwit and Johannes Schmid-Burgk (Max-Planck-Inst. fuer Radioastronomie) Mar. 1982 24 p refs

(CRSR-778) Avail: NTIS HC A02/MF A01

It is suggested that the dissociation of molecular hydrogen by ultraviolet radiation may provide a substantial portion of the momentum required to accelerate molecular clouds to their high, observed velocities. The process, however, is important only when the dissociation front velocity, u, is small compared to the speed of sound in the molecular cloud ahead of the front, or if $u < v_{sub\ o}/10$ where $2v_{sub\ o}$ is the speed of hydrogen atoms released through dissociation of molecules by ultraviolet radiation. M.G.

N82-24060# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Service de la Metrologie et de la Physique Neutroniques.

TAGGED PHOTONS

Leonard C. Maximon, Arlette deMiniac, and Thierry Aniel Mar. 1981 146 p refs In FRENCH

(CEA-N-2203) Avail: NTIS (US Sales Only) HC A07/MF A01; DOE Depository Libraries

The differential cross section for bremsstrahlung for angles and energies in the range of interest for a tagging system is considered. A high energy, small angle approximation for the differential cross section is derived and used for bremsstrahlung to determine the maxima and minimum of the cross section and to evaluate it at these extremes. It is shown that the differential cross section has a very sharp dip in the region of small momentum transfers. Coulomb corrections to the Born approximation are considered, and do not fill in this dip. Some particular cases are

quantitatively described in the range of interest corresponding to the tagged photon facility planned at the 'Accelerateur Lineaire de Saclay' namely: energy of the incoming electron, E1=140 MeV - energy of the tagged photon, k=95 MeV - angle between the incoming electron and the outgoing tagged photon, theta 1 from 0 to 2 degrees - characteristic angles of the tagging electron, theta 2 from 0 to 6 degrees and phi from 0 to 2 degrees. DOE

N82-24061# Houston Univ., Tex. Dept. of Physics.
PION INTERACTIONS AT MEDIUM ENERGIES Progress Report, 1 Dec. 1980 - 30 Nov. 1981
B. W. Mayes, II and E. V. Hungerford, III Jul. 1981 46 p refs
(Contract DE-AS05-76ER-03948)
(DE81-028661; DOE/ER-03948/T1; ORO-394-12) Avail: NTIS HC A03/MF A01

The intermediate energy research program undertaken by the University of Houston during the contract year December 1, 1980, to November 30, 1981 is reviewed. During this period data were obtained on (UC OMEGA) hypernuclei at Brookhaven, on asymmetries in Nuclear-Nucleon pion production at LAMPF, and on measurements of the differences in the transverse spin-spin cross section parameter, (RADICAL) sigma/sub T/, at LAMPF. Data previously acquired on (DELTA) hypernuclei formed in (13)C, (14)N, and (18)O targets, and on pion production from light nuclear targets were analyzed and submitted for publication. Proposals were developed, submitted, and approved for continuing research programs in kaon physics, antinucleon physics, neutrino physics, and high energy heavy ion physics. The development of spectral particle detectors made substantial progress during this past year. DOE

N82-24062# Yerevan Physics Inst. (USSR).
LORENTZ INVARIANCE AND ELEMENTARY PARTICLE PROPERTIES
R. V. Tevikyan 1980 22 p refs In RUSSIAN; ENGLISH summary
(EFI-388(46)-79) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The properties of elementary particles are investigated with emphasis on two principal conditions: existence of the invariant Lagrange function and a complete description of the energy limit E(FEMALE)infinity. A cosmological term is introduced in Einstein equations. Deutrino type particles with helicities -1, +1, -2, +2 in the Minkowsky space are confined. They do not exist in a free state. In spaces with metrices (++++) and (++--) the confinement is absent. DOE

N82-24063# Flinders Univ., Bedford Park (Australia). Inst. for Atomic Studies.
NATURE OF THE POSITIVE ION CONRIBUTION TO A GAS DISCHARGE
J. Fletcher and H. A. Blevin Jun. 1980 10 p refs
(FIAS-R-68) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The technique for studying swarms of electrons in a gas discharge by observing the photon flux from the discharge was adapted to investigate the role of the secondary mechanisms in hydrogen and nitrogen. Ion bombardment of the cathode plays only a negligible, if any, part in the low pressure discharge in hydrogen and nitrogen at low E/N while at high E/N only the contribution of the atomic ion is significant. DOE

N82-24064# Flinders Univ., Bedford Park (Australia). Inst. for Atomic Studies.
TRANSPORT PARAMETERS OF AN ELECTRON SWARM IN NITROGEN AT ELEVATED E/N
H. A. Blevin, J. Fletcher, and I. D. Reid Jun. 1980 11 p refs
(FIAS-R-69) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Values of the electron drift velocity, the longitudinal diffusion coefficient, and the transverse diffusion coefficient for electron swarms in nitrogen over the range 50 Td < or = E/N < 500 Td were determined by a method of counting and analyzing the photons produced by such an electron swarm in a drift tube. A measure of the Nitrogen E state deactivation rate is presented. DOE

N82-24065# Toulouse Univ. (France).
SPECTROSCOPIC STUDY OF ENERGY LOSSES DURING THE INELASTIC AND ELASTIC COLLISION PROCESSES IN A He(+) -He SYSTEM Ph.D. Thesis
Andre Julia Sep. 1980 125 p refs In FRENCH; ENGLISH summary
(FRNC-TH-954) Avail: NTIS (US Sales Only) HC A06/MF A01; DOE Depository Libraries

Differential cross sections resulting from a collision of an He(+) ion beam with an atomic target were experimentally measured. The energy range extends from 3 up to 50 keV and the angular range extends from 15' up to 30 deg (laboratory system). These cross sections are compared to theoretical cross sections proceeding from the McCarroll method. Total experimental cross sections are given. DOE

N82-24066# Flinders Univ., Bedford Park (Australia). Inst. for Atomic Studies.
POLARIZATION POTENTIAL IN ELECTRON-ATOM SCATTERING
I. E. McCarthy, B. C. Saha, and A. T. Stelhovics Feb. 1981 41 p refs
(FIAS-R-74) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The polarization potential for electron-atom scattering was investigated analytically in momentum space. Contributions from discrete and continuum excitations are treated in detail. The equilvalent-local polarization potential V(P) is derived, and calculated for the case of hydrogen at several energies. Contributions to the polarizability, defined as -8(LCOMEGA) times the derivative of V(P) at P = O, and terms of range as long as r(+4) are zero unless the corresponding potential contains a singular integral, which is investigated in detail. Contrast is drawn with the adiabatic potential, which is local but different from the equivalent-local potential. DOE

N82-24067# Hebrew Univ., Jerusalem (Israel). Center for Plasma Physics.
INTERPRETATION AND RELATIVISTIC EXTENSION OF BELY'S APPROXIMATION FOR EXCHANGE IN ELECTRON ION COLLISIONS
M. Klapisch, J. Oreg (Nuclear Research Center of the Negev, Beersheva, Israel), and A. Bar-Shalom CEA Apr. 1981 10 p refs Sponsored by CEA
(DE81-700569; EUR-CEA-FC-1099) Avail: NTIS (US Sales Only) HC A01/MF A01; DOE Depository Libraries

It is pointed out that Bely's approximation for exchange in excitation cross sections by electronic collisions is equivalent to considering a contact interaction between free and bound electrons. This allows the corresponding formula for relativistic wavefunctions and for many electron atoms to be obtained and the quality of the approximation to be discussed. DOE

N82-24068# Oak Ridge National Lab., Tenn. Physics Div.
COMPILATION OF THEORETICAL ELECTRON-IMPACT EXCITATION CROSS SECTIONS FOR Fe ATOMIC IONS
M. S. Pindzola and D. H. Crandall Nov. 1981 42 p ref
(Contract W-7405-eng-26)
(DE82-001951; ORNL/TM-7957) Avail: NTIS HC A03/MF A01

The compilation of excitation cross sections for Fe ions represents the recommended collision cross sections for impurity ions of fusion interest. Compilation of excitation and electron capture data for C and O ions is currently in progress. It is suggested that at present the Lotz formula is the best overall predictor for ionization cross sections with 0.85 of the Lotz formula a slight improvement for ion +1 through +3. Indirect processes such as excitation/autoionization can cause the Lotz formula to be an underestimate of ionization for specific ions, particularly heavy ions with three or more attached electrons. Recombination formulas are in use but are of highly uncertain reliability. DOE

N82-24069# Japan Atomic Energy Research Inst., Tokyo. Div. of Physics.
DATA ON COLLISIONS OF HELIUM ATOMS AND IONS WITH ATOMS AND MOLECULES. 1: CROSS SECTIONS FOR CHARGE TRANSFER OF He, He+ AND He++ WITH

H, H2 AND He
Y. Nakai, Masao Sataka (Tokyo Inst. of Technology), and Toshizo Shirai May 1980 55 p refs In JAPANESE; ENGLISH summary
(JAERI-M-8849) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

This report presents a compilation of the experimental data on cross sections for charge transfer of He, He(+), and He(++) with H, H2, and He. The cross sections are given as a function of projectile energy in graphs and tables. DOE

N82-24070# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
PULSED ELECTRON BEAM GENERATOR FOR APPLICATION IN MATERIALS SCIENCE
J. Geerk and F. Ratzel Aug. 1980 16 p refs In GERMAN; ENGLISH summary
(KFK-2912) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

A pulsed electron beam generator for the purpose of transient annealing was developed. The principle of operation of the generator is the production of an electron beam by means of a triggered vacuum discharge burning between metallic electrodes. The maximum energy of the electrons of a pulsed beam may be varied between 10 keV and 25 keV. The pulse length is about 300 nsec. The energy density at the sample location can be easily adjusted between 0.3 and 2.5 Joules/cm(2). The diameter of the electron beam is about 5 cm. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N82-24071# Texas Univ., Austin. Dept. of Physics.
PROGRESS IN RESEARCH Progress Report, 1 Jan. - 31 Oct. 1981
Nov. 1981 65 p refs
(Contract DE-AS05-81ER-40031)
(DE82-004123; DOE/ER-40031/T1) Avail: NTIS HC A04/MF A01

Basic research in nuclear physics is reviewed in the following areas: reactions induced by low energy light ions, heavy ion induced reactions, medium energy physics, and nuclear collective motions. DOE

74 OPTICS

Includes light phenomena.

N82-24072* National Aeronautics and Space Administration. Pasadena Office, Calif.
CONSTANT MAGNIFICATION OPTICAL TRACKING SYSTEM Patent
Robert E. Frazer, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) Issued 16 Mar. 1982 7 p Filed 30 Apr. 1980 Supersedes N80-24152 (18 - 14, p 1915) Sponsored by NASA
(NASA-Case-NPO-14813-1; US-Patent-4,320,290; US-Patent-Appl-SN-145282; US-Patent-Class-250-216; US-Patent-Class-250-235) Avail: US Patent and Trademark Office CSCL 20F

A constant magnification optical tracking system for continuously tracking of a moving object is described. In the tracking system, a traveling objective lens maintains a fixed relationship with an object to be optically tracked. The objective lens was chosen to provide a collimated light beam oriented in the direction of travel of the moving object. A reflective surface is attached to the traveling objective lens for reflecting an image of the moving object. The object to be tracked is a free-falling object which is located at the focal point of the objective lens for at least a portion of its free-fall path. A motor and control means is provided for mantaining the traveling objective lens in a fixed relationship relative to the free-falling object, thereby keeping the free-falling object at the focal point and centered on the axis of the traveling objective lens throughout its entire free-fall path. M.D.K.

N82-24073# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Experimentale Atmosphaerenphysik II.
FOUNDATIONS OF A NUMERICAL MODEL OF SLANT VISIBILITY
Gerhard H. Ruppersberg Oct. 1981 120 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-575)
(DFVLR-FB-82-01; ESA-TT-575) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 33.60

The slant visibility of objects seen against a background different from sky at the horizon is treated. The complex interaction between the numerous parameters of observation and environment is numerically interpreted. The computer programming is explained. A specific interpolation procedure was developed, using experimental experience, which essentially reduces computer time. It was applied to a selection of modelling parameters which led to a contrast transmittance model, presenting slant visibility at idealized inherent contrast and contrast threshold. Results provide a framework for a slant visibility model which is valid for real values of inherent contrast and contrast threshold. Author (ESA)

N82-24074# Paris-Sud Univ., Orsay (France). Lab. de Physique des Gaz et des Plasmas.
APPARATUS FOR THE MEASUREMENT OF LINEAR AND CIRCULAR DICHROISM IN THE FAR ULTRAVIOLET. PART 1: CHARACTERISTICS OF THE MONOCHROMATOR AND OF THE ARGON MINI-ARC [DISPOSITIF POUR LA MESURE DU DICHROISME LINEAIRE ET CIRCULAIRE DANS L'ULTRAVIOLET LOINTAIN. PREMIERE PARTIE: CARACTERISTIQUES DU MONOCHROMATEUR ET DU MINI ARC A ARGON]
M. Pouey Jul. 1981 31 p refs
(LP-191-1) Avail: NTIS HC A03/MF A01

A secondary standard light source was developed. The phase balancing method and the brightness conservation law were used to optimize a stigmatic grating device which matches exactly the spectrum of the source and which delivers well collimated output beams. The optical design of the dispersed source for absolute calibrations, using an argon mini-arc and a specially designed stigmatic normal incidence monochromator, is described. Such a device can also be used in microlithography (high flux in a limited passband being traded off for improved resolution), in photochemistry and in fluorescence measurements with simplified or speeded up detection systems. Author (ESA)

N82-24075# California Univ., Berkeley.
NONLINEAR OPTICS AT INTERFACES Ph.D. Thesis
Chenson K. Chen 1981 83 p
Avail: Univ. Microfilms Order No. 8200051

Nonlinear interaction of surface plasmons and bulk photons at metal dielectric interfaces was explored. The surface enhanced second harmonic generation at rough metal surfaces was investigated. A general formulation for nonlinear interaction of surface plasmons at metal dielectric interfaces is presented and applied to both second and third order nonlinear processes. Experimental results for coherent second and third harmonic generation by surface plasmons and surface coherent anti-Stokes Raman spectroscopy are shown to be in good agreement with the theory in the case of second harmonic generation, it is demonstrated that two counterpropagating surface plasmons at a silver crystal quartz interface result in a coherent second harmonic output propagating along the surface normal, as required by momentum conservation. The experimental observation of a 10,000 increase of the second harmonic signal at a rough metal air interface compared to a smooth surface provides the first unambiguous demonstration that the local field on rough surface structures can lead to a large enhancement in the strength of a nonlinear optical process. Dissert. Abstr.

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N82-24076# California Univ., San Diego.
THERMAL EQUILIBRIA AND WAVE PROPERTIES OF FINITE LENGTH PURE ELECTRON PLASMA COLUMNS Ph.D. Thesis
Sharada Ananth Prasad 1981 125 p
Avail: Univ. Microfilms Order No. 8129252

A theory for the low frequency electrostatic modes of a finite length pure electron plasma column is presented. The plasma is modeled as a cold uniform density cylinder with flat ends; thermal effects and the effect of smoothing the radial profile are later introduced as perturbations to calculate the damping of the modes. The model potential vanishes on the wall of a surrounding conductor. The diocotron mode can have an axial wavelength that is much larger than the plasma length. The diocotron mode is degenerate with a plasma mode, and this results in a strong mixing of the modes. The inclusion of thermal effects provides a strong signature for the degeneracy. Dissert. Abstr.

N82-24077# Ohio State Univ., Columbus.
ELECTROSTATIC INSTABILITY OF A MAGNETICALLY CONFINED HELIUM ARC Ph.D. Thesis
Tony Stephen Taylor 1981 182 p
Avail: Univ. Microfilms Order No. 8129107

A helium arc of 16 to 24 cm length between an incandescent annular cathode and a flat water cooled anode was operated in an axial magnetic field of 2 to 10 kilogauss. The helium gas pressure was varied between 1 and 15 Torr, and the total current was varied between 2 and 6 kiloampere. In order to characterize the arc plasma operated under these conditions, the temperature, electron density, pressure, current density profile, electric fields, axial flow, and arc rotation were measured. Data indicate azimuthal mode numbers 1 and 2. The phase and amplitude are nearly constant along the arc column. The frequency and amplitude both increase with increasing arc current and decrease with increasing pressure. The amplitude, however, decreases with increasing magnetic field while the frequency is only weakly affected by magnetic field. The data indicate that the oscillations involve flute-type perturbations of the arc boundary. Frequencies and mode numbers observed are compared with an ideal magnetohydrodynamic calculation of Rayleigh-Taylor instabilities of a rotating plasma column surrounded by a gas of nonzero density. Dissert. Abstr.

N82-24078*# Wichita State Univ., Kans. Dept. of Mechanical Engineering.
NUMERICAL MODELING OF THREE-DIMENSIONAL CONFINED FLOWS Final Report
Mahesh S. Greywall Aug. 1981 76 p refs
(Grant NsG-3186; Contract DE-AI01-77ET-10769)
(NASA-CR-165583; NAS 1.26:165583) Avail: NTIS HC A05/MF A01 CSCL 20I

A three dimensional confined flow model is presented. The flow field is computed by calculating velocity and enthalpy along a set of streamlines. The finite difference equations are obtained by applying conservation principles to streamtubes constructed around the chosen streamlines. With appropriate substitutions for the body force terms, the approach computes three dimensional magnetohydrodynamic channel flows. A listing of a computer code, based on this approach is presented in FORTRAN IV language. The code computes three dimensional compressible viscous flow through a rectangular duct, with the duct cross section specified along the axis. S.L.

N82-24079*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MHD ELECTRICAL GENERATOR Patent Application
Dennis J. Fitzgerald, inventor (to NASA) (JPL, California Inst. of Technology, Pasadena) Filed 14 Feb. 1982 13 p
(Contract NAS7-100)
(NASA-Case-NPO-15399-1; US-Patent-Appl-SN-330612) Avail: NTIS HC A02/MF A01 CSCL 20I

An MHD (magnetohydrodynamic electric generator is provided which is of high efficiency and which can operate in a closed cycle with minimal moving parts for unattended applications. The generator includes a porous tungsten element heated by a heat source and a system for passing primarily pure cesium vapor into the porous element, to produce contact ionization of the cesium with a higher percentage of ions than can be sustained. The highly ionized cesium vapor, and corresponding numbers of electrons from the tungsten element, recombine to produce a much higher temperature as the cesium flows through a tube past an MHD converter that generates electricity, and into a cool end of the tube where the cesium is cooled to a liquid temperature. The liquid can be recirculated by passing it through capillary passages extending towards the location where cesium vapor enters the porous tungsten element. NASA

N82-24080# Nagoya Univ. (Japan). Inst. of Plasma Physics.
POPULATION INVERSION IN AN OPTICALLY THICK RECOMBINING HYDROGEN PLASMA
Utaro Furukane, Toshiaki Yokota, Ken Kawasaki, and Toshiatsu Oda Mar. 1982 18 p refs
(IPPJ-552) Avail: NTIS HC A02/MF A01

The plasma condition is theoretically investigated for the population inversion between the first two excited states of hydrogen atoms in a recombining plasma. The rate equation including atom-atom collision terms is solved consistently with the optical escape factors. The upper bound value of the ground level population density (n sub 1) max necessary for inversion in the optically thick plasma at specified electron density and temperature is almost inversely proportional to the mean radius of the plasma r sub 0. With decrease in the atom temperature, the upper bound values increase in optically thin plasma, but decrease in the optically thick plasma. M.G.

N82-24081# Nagoya Univ. (Japan). Inst. of Plasma Physics.
BREMSSTRAHLUNG ENERGY LOSS OF DEGENERATE PLASMA
Seiya Yamaguchi (Tokyo Inst. of Technology), Shigeo Kawata, Takashi Abe, and Keishiro Niu Mar. 1982 9 p refs
(IPPJ-553) Avail: NTIS HC A02/MF A01

The integrated emission coefficient for Bremsstrahlung is derived for a plasma with an arbitrary electron degeneracy. This coefficient is shown to have two plausible limiting values of classical and fully degenerate cases. It is pointed out that the effect of electron degeneracy reduces the Bremsstrahlung energy loss to 0.01 times of that in the nondegenerate case in the typical state of an inertial confinement fusion target whose number density is 4.5 x 10 to the 26th power/cu cm and temperature is one-million K. M.G.

N82-24082# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTRON CYCLOTRON HEATING OF STELLARATOR PLASMA WITH THE ORDINARY AND THE EXTRAORDINARY MODES
K. Ohkubo, K. Kawahata, N. Noda, I. Ogawa, E. Kako, S. Tanahashi, K. Matsuura, J. Fujita, T. Cho (Kyoto Univ.), and Y. Terumichi (Kyoto Univ.) Mar. 1982 18 p refs
(IPPJ-554) Avail: NTIS HC A02/MF A01

Experimental studies of electron cyclotron heating in stellarator plasma were carried out by injecting 40 kW of 35.5-GHz microwave power. Electron cyclotron heatings with the ordinary and the extraordinary modes injected from the low field side show almost the same heating efficiency of 2.2 x 10 to the 13th power eV/cu cm/kW at the averaged electron density of 6 x 10 to the 12th power/cu cm. Efficient heating by the extraordinary mode in the presence of the cyclotron cutoff is interpreted to be achieved by the penetration of scattered waves from high and low field sides, because the wave polarization is scrambled by the reflection at the chamber wall. M.G.

N82-24083# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONVERSION OF COMPRESSIONAL ALFVEN WAVES INTO ION CYCLOTRON WAVES IN INHOMOGENEOUS MAGNETIC FIELDS
Y. Amagishi (Shizuoka Univ.), A. Tsushima, and M. Inutake (Tsukuba Univ.) Mar. 1982 14 p refs
(IPPJ-555) Avail: NTIS HC A02/MF A01

Axisymmetric compressional Alfven (fast) waves, which propagate into a region of an increasing magnetic field in a cylindrical plasma, were observed to be converted into ion cyclotron (slow) waves via ion cyclotron resonances. The conversion is believed to occur even in a fully ionized and quite high-conducting plasma and may be used for plasma heating. M.G.

N82-24084# Nagoya Univ. (Japan). Inst. of Plasma Physics.
POSSIBLE METHOD FOR BURN CONTROL BY COMPRESSION-DECOMPRESSION
Masao Okamoto, Masami Ohnishi, and Kei-ichi Hirano Mar. 1982 12 p refs
(IPPJ-559) Avail: NTIS HC A02/MF A01

A possible method for the control of burning plasmas in ignited Tokamaks is presented. By applying the small scale major radius compression-decompression repeatedly to the plasma with the feedback control, the thermal instability can be suppressed and the plasma stays at an unstable ignition equilibrium point. The variation of major radius delta during the control scales like delta R/R is similar to -delta n/2n, where R is the major radius, n is the density and delta n is the change in density during control. M.G.

N82-24085# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILIZATION OF ELECTROSTATIC FLUTE MODE DUE TO HOT ELECTRON RING AND RF FIELD
H. Sanuki Mar. 1982 29 p refs
(IPPJ-558) Avail: NTIS HC A03/MF A01

The stability of electrostatic flute modes was studied on the basis of a relatively simple model of a bumpyless cylinder with artificial gravity and an ambipolar field. The dynamic stabilization of these modes due to the RF electric field was also discussed. It turned out that the electrostatic flute modes could be stabilized effectively by the RF field together with the effects of a hot electron ring. M.G.

N82-24086# Nagoya Univ. (Japan). Inst. of Plasma Physics.
HEAT FLUX IN THE PRESENCE OF SHIFTING COLD AND HOT ELECTRON MAXWELLIAN DISTRIBUTIONS
Hideo Ichiba and Masatada Ogasawara (Keio Univ.) Mar. 1982 18 p refs
(IPPJ-557) Avail: NTIS HC A02/MF A01

Heat flux is evaluated in the case of shifted Maxwellian velocity distribution function with cold and hot electrons. The heat flux associated with the cold electron temperature gradient nabla sub x T sub C tends to flow in the direction of increasing T sub C. This flux inversion is enhanced due to the shifting velocities of the cold and hot electrons. Even for a small shifting velocity as mv(2) sub H/2T sub H = 0.3 (v sub H and T sub H are the shifting velocity and the temperature of the hot electrons), value of the heat flux becomes more than twice as large as the value without the shifting velocities. M.G.

N82-24087# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MODE CONVERSION AND LOCAL HEATING BELOW THE SECOND ELECTRON CYCLOTRON HARMONIC
H. Sugai Mar. 1982 14 p refs
(IPPJ-556) Avail: NTIS HC A02/MF A01

An extraordinary wave is normally incident on a large volume magnetoplasma. Below the second gyroharmonic, conversion into short wavelength Bernstein wave is observed near the upper hybrid layer. Significant conversion efficiency is attained in the optimum conditions. In the high power incidence, considerable electron heating due to the converted wave is localized in the mode conversion region. S.L.

N82-24088# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
UWTOR-M, A STELLARATOR POWER REACTOR UTILIZING MODULAR COILS
I. N. Sviatoslavsky, S. W. Vansciver, and G. I. Kulcinski Oct. 1981 19 p refs Presented at Meeting and Workshop on Fusion Reactor Design and Technol., Tokyo, 5 Oct. 1981
(Contract DE-AS02-78ET-52048)
(DE82-002905; DOE/ET-52048/20; UMFDM-439; CONF-811046-12) Avail: NTIS HC A02/MF A01

The parametric considerations which led to the UWTOR-M reference design point are described. The design has 18 twisted coils utilizing a multipolarity of 3, a major radius of 24 m, a coil radius of 4.77 m and a plasma aspect ratio of 14. An assumed (ALPHA) of 5% was used. This configuration leads to a rotational transform on the edge of 1.125 giving favorable plasma physics conditions. The natural stellarator divertor is used for impurity control in conjunction with innovative high performance divertor targets. A unique blanket design which minimizes tritium inventory in the reactor is proposed. A scheme for servicing the first wall/blanket and other reactor components is described. DOE

N82-24089# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
STABILITY PROPERTIES OF KINK-INTERCHANGE MODES IN A PLASMA CONTAINING ALPHA PARTICLES
Jan Weiland 1980 14 p refs
(DE81-700006; CTH-IEFT/PP-1980-20) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The linear and nonlinear stability properties of pressure driven electromagnetic interchange modes are investigated in the presence of a transverse current gradient. Possibilities for both stabilization and destabilization are obtained. The influence of nonlinear mode interactions is considered and explosively unstable situations are found. The influence of injected ions and fusion generated alpha particles are also discussed. In particular it is demonstrated for a slab geometry that the curvature drift of fusion generated alpha particles is not serious for the stability. DOE

N82-24090# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics.
FORMATION ON NONLINEAR MAGNETIC ISLANDS AND DIFFUSION IN INHOMOGENEOUS PLASMAS
V. P. Pavlenko (Academy of Sciences of the Ukrainian SSR, Kiev, USSR) and J. Weiland 1980 21 p refs
(DE81-700005; CTH-IEFT/PP-1980-15) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Examination of the formation of nonlinear magnetic islands by modulational instability of the magnetic drift mode reveals that a background current is necessary for the process. In an inhomogeneous plasma, the thermal conductivity caused by the nonlinear islands may dominate that caused by the linear islands. DOE

N82-24091# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.
STEADY-STATE SOLUTIONS FOR THE PENETRATION OF A ROTATING MAGNETIC FIELD INTO A PLASMA COLUMN
Ieuan R. Jones and Waheed N. Hugrass Jul. 1980 25 p refs
(FUPH-R-166) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The penetration of an externally applied rotating magnetic field into a plasma cylinder is examined. Steady state solutions of an appropriate set of magnetofluid equations show that, provided the amplitude and rotation frequency of the field are suitably chosen, the penetration is not limited by the usual classical skin effect. The enhanced penetration of the rotating field is accompanied by the generation of an unidirectional azimuthal electron current which is totally absent in a purely resistive plasma cylinder. DOE

N82-24092# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
ASYMMETRIC ELECTRON CYCLOTRON EMISSION FROM SUPERTHERMAL ELECTRONS IN THE TFR TOKAMAK
Mar. 1981 17 p refs
(EUR-CEA-FC-1091) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Measurements of electron cyclotron radiation near the fundamental frequency on the high and low magnetic field side of the TFR Tokamak are reported. In the presence of a superthermal electron component the measured intensities are asymmetric. A theoretical explanation based on the combined effects of the electron relativistic mass variation and the 1/R variation of the Tokamak magnetic field is discussed. DOE

N82-24093# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.

SPECTROSCOPIC STUDY OF OHMICALLY HEATED TOKAMAK DISCHARGES

C. Breton, C. deMichelis, and M. Mattioli Jul. 1980 44 p refs Presented at the 10th Summer School and Symp. on the Phys. of Ionized Gases (SPIG 80), Dubrovnik, Yugoslavia, 25-30 Aug. 1980

(EUR-CEA-FC-1060) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

Tokamak discharges which interact strongly with the wall and/or the current aperture limiter producing recycling particles and which penetrate into the discharge were studied spectroscopically. Working gas (hydrogen or deuterium) was studied observing visible Balmer lines at several toroidal locations. Absolute measurements for both the recycling flux and the global particle confinement time were obtained. With sufficiently high resolution the isotopic plasma composition was also obtained. The impurity elements were divided into desorbed elements and eroded elements according to the plasma-wall interaction processes originating them. The initial phase, the period of increasing plasma current and electron temperature, an eventual steady state phase and the phase of the increase of the electron density was studied. Results reported from different devices are described and compared. M.D.K.

N82-24094# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.

THREE-DIMENSIONAL TRANSPORT MODEL FOR TOROIDAL PLASMAS

C. Copenhauer Dec. 1980 57 p refs

(EUR-CEA-FC-1076) Avail: NTIS (US Sales Only) HC A04/MF A01; DOE Depository Libraries

A nonlinear MHD model, developed for three dimensional toroidal geometries (asymmetric) and for high (ALPHA)((ALPHA) approximately epsilon), is used as a basis for a three dimensional transport model. Since inertia terms are needed in describing evolving magnetic islands, the model can calculate transport, both in the transient phase before nonlinear saturation of magnetic islands and afterwards on the resistive time scale. In the (ALPHA) approximately epsilon ordering, the plasma does not have sufficient energy to compress the parallel magnetic field, which allows the Alfven wave to be eliminated in the reduced nonlinear equations, and the model then follows the slower time scales. The resulting perpendicular and parallel plasma drift velocities can be idenfified with those of guiding center theory. DOE

N82-24095# Association Euratom-CEA, Grenoble (France). Dept. of de Recherches sur la Fusion Controlee.

PARAMETRIC INSTABILITIES IN AN ELECTRON BEAM PLASMA SYSTEM

R. Nakach, S. Cuperman (Tel-Aviv Univ., Israel), Y. Gell (Tel-Aviv Univ., Israel), and B. Levush (Tel-Aviv Univ., Israel) Jan. 1981 44 p refs

(EUR-CEA-FC-1078) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The excitation of low frequency parametric instabilities by a finite wave length pump in a system consisting of a warm electron plasma traversed by a warm electron beam is investigated in a fluid dissipationless model. The dispersion relation for the three dimensional problem in a magnetized plasma with arbitrary directions for the waves is derived, and the one dimensional case is analyzed numerically. For the one dimensional backscattering decay process, it is found that when the plasma-electron Debye length (lambda sub (D)sup(p)) is larger than the beam-electron Debye length (lambda sub(D)sup(b)), two low frequency electrostatic instability branches with different growth rates may simultaneously exist. When lambda sub(D)sup(p) approximately lambda sub(D)sup(b), the large growth rate instability found in the analysis depends strongly on the amplitude of the pump field. In the case (lambda sub(D)sup(p) < lambda sub(D)sup(b)) only one low frequency instability branch is generally excited. DOE

N82-24096# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.

GENERATION OF STEADY CURRENTS IN A PLASMA CYLINDER USING RF WAVES

Waheed N. Hugrass Oct. 1980 37 p refs

(FUPH-R-169) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

The generation of a steady current in a resistive plasma cylinder by means of a travelling wave magnetic field was studied using the resistive MHD equations. The nonlinear initial-boundary value problem was solved using a semi-Lagrangian two dimensional algorithm. The numerical code was used to simulate the Synchromak experiment of Nagoya University. Hollow d.c. current profiles, similar to the experimental data, were obtained. A simple analytical argument, of a more general nature, shows that classical resistive diffusion cannot lead to a more uniform current distribution. DOE

N82-24097# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.

STABILITY ANALYSIS OF SOME EQUILIBRIA IN A STABILIZED Z-PINCH

J. Tendys Jul. 1981 38 p refs

(DE81-700590; FUPH-R-174) Avail: NTIS (US Sales only) HC A03/MF A01; DOE Depository Libraries

A number of plasma conditions were examined in the linear z-pinch, FUZA-2. Equilibrium radial profiles were measured for the axial and azimuthal magnetic fields and for the density. These equilibria were analyzed with the THALIA and RIPPLE programs to find the wavelength and growth times of the most unstable m=1 modes. These predictions were compared with measurements made of the wavelength and growth times with 120 deg. sector coils under the same plasma conditions. The agreement for the growth times was good for discharge with a low mass density filling, but the experimental values were two times larger than the theoretical ones for the cases with a high mass density filling. In the cases where wavelengths could be measured, the agreement between theory and experiment was good. DOE

N82-24098# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.

NUMERICAL STUDY OF THE GENERATION OF AN AZIMUTHAL CURRENT IN A PLASMA CYLINDER USING A TRANSVERSE ROTATING MAGNETIC FIELD

Waheed N. Hugrass and R. C. Grimm Jul. 1980 21 p refs (FUPH-R-167) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The generation of a steady azimuthal current in a cylindrical plasma column using a rotating magnetic field is numerically investigated. The mixed initial-boundary-value problem is solved using a finite difference method. It is shown that substantial azimuthal current can be driven provided that the amplitude of the rotating magnetic field is greater than a certain threshold value which depends on the plasma resistivity. DOE

N82-24099# Toulouse Univ. (France).

EXPERIMENTAL AND THEORETICAL STUDIES OF RECOMBINATION IONIZATION AND DIFFUSION PROCESSES IN AN ARC PLASMA Ph.D. Thesis

C. Maury Jun. 1980 133 p refs In FRENCH; ENGLISH summary

(FRNC-TH-953) Avail: NTIS (US Sales Only) HC A07/MF A01; DOE Depository Libraries

The changes in the electron density and excited atom density in a wall-stabilized arc burning in argon at atmospheric pressure were determined and the changes in electronic temperature and the difference between electronic temperature and gas temperature were deduced. These parameters were found by means of two wavelength laser interferometry and spectroscopy measurements. By means of a collisional radiative model, ionization and recombination coefficients were found. The different plasma parameters and the electronic energy losses were analyzed. The electronic loss processes during the early stages of arc extinction were studied. DOE

N82-24100# Association Euratom-CEA, Fontenay-aux-Roses (France). Dept. de Recherches sur la Fusion Controlee.

VARIATIONAL METHODS FOR STUDYING THE EVOLUTION OF A PLASMA. APPLICATION TO TOKAMAK Ph.D. Thesis

G. Requin May 1981 252 p refs In FRENCH
(DE81-700589; EUR-CEA-FC-1104) Avail: NTIS (US Sales Only) HC A12/MF A01; DOE Depository Libraries

A variational principle was converted into a directly usable form to monitor the evolution of a hot confined plasma. It was found that useful information on the phenomena associated with stochastic processes can be obtained by applying the variational principles. The application of these variational principles was limited to Tokamak. Applications of this method other than those listed for Tokamak are possible. Non-linear effects with respect to density and temperature gradients could for example be investigated. The principles studied can be applied in order to obtain dispersion relations, to calculate transport coefficients, and even saturation levels under complex conditions. Results of these calculations have led to modifications in experiments associated with projected Tokamak and suggestions for further experiments. The level of ripple that can be admitted for strongly heated machines was examined. The rotating of the plasma in order to decontaminate it by removing heavy impurities was considered together with the practical means necessary to realize this operation. Two divertor schemes were also examined: an H.F. electric field divertor, an ergodic divertor. M.D.K.

N82-24101# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Recherches sur la Fusion Controlee.
TEARING MODE IN THE LONG WAVELENGTH LIMIT
R. B. Paris Jun. 1981 15 p refs
(DE81-700585; EUR-CEA-FC-1090) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The value of the logarithmic derivative (RADICAL)' in the boundary layer for the plane symmetric resistive tearing mode is calculated analytically for arbitrary wavelength parameter (-) approximately < 1. Its value is given. The familiar 'constant-psi' approximation corresponding to lambda approximately 0 is discussed. The analytic forms in the boundary layer of the normalized magnetic field and velocity perturbations psi and U are obtained. DOE

N82-24102# Central Inst. of Physics, Bucharest (Romania). Inst. for Physics and Technology for Radiation Devices.
STUDY OF THE EXCITATION PROCESSES IN A LOW POWER NITROGEN PLASMATRON
Mohamed A. M. El-Osairy, I. Iova (Bucharest Univ.), G. Musa, and C. P. Lungu Mar. 1980 18 p refs
(IFTAR-LOP-11-1980) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The behavior of a nitrogen plasma jet operating at pressures between 10 Torr and 35 Torr was investigated spectroscopically. The relative intensity was plotted against the pressure, plasmatron power, and against the plasma jet length for different pressures. The radial distributions of the relative intensities for the same spectral lines against the plasma jet length was plotted too. The measurements were taken for two wolfram spectral lines and two heads of second positive nitrogen molecular bands. DOE

N82-24103# Oak Ridge National Lab., Tenn. Fusion Energy Div.
USING A CONSTANTS-OF-MOTION SPACE TO CLARIFY MEASUREMENTS INVOLVING ENERGETIC ION ORBITS IN TOKAMAKS
J. A. Rome, J. F. Lyon, and R. H. Fowler Oct. 1981 38 p refs
(Contract W-7405-eng-26)
(DE82-001361; ORNL/TM-7913) Avail: NTIS HC A03/MF A01

In Tokamaks with low plasma current, energetic ion guiding center orbits can have large deviations from a poloidal flux surface. Analyses of the fast ion orbit topology in a local constants of motion space (epsilon, (SIGMA), P sub phi) and in a more physical space (R,v sub parallel/v,epsilon) are used to define the wall loss regions, the trapped particle regions, and the various types of fast ion orbits that must be taken into account in interpreting high energy charge exchange or neutron measurements in Tokamaks. DOE

N82-24104# Japan Atomic Energy Research Inst., Tokyo. Div. of Thermonuclear Fusion Research.
CALCULATION OF TEMPERATURE DISTRIBUTION OF TUNGSTEN FILAMENT CATHODE IN GASEOUS DISCHARGE. IN THE CASE OF CONSTANT HEATER CURRENT
S. Tanaka Nov. 1980 39 p refs In JAPANESE; ENGLISH summary
(DE81-700010; JAERI-M-9152) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

Temperature, distribution of a tungsten filament cathode in gaseous discharge was calculated in the case where the filament power supply was regulated to keep a constant current. Heating of the filament due to ion bombardment and electron emission cooling as well as heating due to discharge current were taken into account. Calculations were carried out for the filament diameters of 0.5 to 1.8 mm. The temperature distribution of the filament becomes non-uniform with the increase of discharge current and the position of maximum temperature shifts nearer to the negative leg of the filament. Nonuniformity of the distribution increases for the thinner filament. When the density of plasma surrounding the filament is sufficiently high, the filament can emit thermionic electrons up to the temperature limited level. In this case, the discharge current passes through and heats up the filament, then the current increases. Thus, the temperature distribution tends to become non-uniform with the increase of plasma density. DOE

N82-24105# Japan Atomic Energy Research Inst., Tokyo. Div. of Large Tokamak Development.
EVALUATION OF MECHANICAL STRENGTH OF THE JOINTS IN JT-60 TOROIDAL FIELD COIL CONDUCTORS
S. Nishio, Minoru Ohkubo, and Hiroshi Sasajima (Hitachi Works of Hitachi Ltd.) Apr. 1980 28 p refs In JAPANESE; ENGLISH summary
(JAERI-M-8822) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

Toroidal field (TF) coils of JT-60 produce a toroidal field of 45 KG at a plasma axis, they have an inner bore of 3.90 m and a weight of about 80 metric tons per coil. Eighteen TF coils are located around a torus axis at regular intervals. TF coil conductors are mostly jointed by high frequency induction brazing, the rest jointed by welding. In deciding the details of the jointing procedures, the conductor size and the requested mechanical strength are mainly taken into consideration. Described are non-destructive inspection methods for the brazed joints, strength evaluation, and the inspection criteria. Ultrasonic testing method is found to be the most effective in evaluation of mechanical properties of the brazed joints especially in terms of fatigue strength. The ultrasonic inspection method and the detectability of this apparatus are described in detail, and the defects of known size are compared with the indication values and display figures. The apparatus developed for JT-60 is operated automatically also recording the inspection results. Mechanical strength of the brazed joints with initial defects is discussed. DOE

N82-24106# Japan Atomic Energy Research Inst., Tokyo. Fusion Research and Development Center.
SOME CONSIDERATIONS OF DESIGN ISSUES ON TOROIDAL FIELD RIPPLE
T. Tone, Takashi Yamamoto (Fuji Electric Col, Ltd.), Keiji Tani, Masayoshi Sugihara, and Masao Kasai (Mitsubishi Atomic Power Industries, Inc.) Jun. 1980 21 p refs
(JAERI-M-8938) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The effect of toroidal field ripple on the injected beam ion confinement and the ripple level required for stable burning for the INTOR plasma is described. The confinement of beam ion is analyzed with a Monte Carlo orbit following calculation code and the burn control is simulated with a one dimensional transport code. DOE

N82-24107# Japan Atomic Energy Research Inst., Tokyo. Div. of Large Tokamak Development.
PHYSICS PROGRAMMES AND GOALS OF LARGE TOKAMAK EXPERIMENTS
A. Ogata, comp. Dec. 1980 37 p refs Presented at the Phys. Session of the 4th IAEA Tech. Comm. Meeting on Large Tokamak Experiments, Tokyo, 14-18 Apr. 1980
(DE81-700016; JAERI-M-9228) Avail: NTIS (US Sales Only)

HC A03/MF A01; DOE Depository Libraries

Physics programs an goals of four large Tokamak experiments (LTX), Jet, TFTR, JT-60 and T-15 are described. Physics problems foreseen in LTX are reviewed in light of results from Tokamaks in operation. Programs and objectives of LTX are described by each project. Their various aspects are then reviewed. Possible collaborative programs among the projects are briefly discussed. Author

N82-24108# Japan Atomic Energy Research Inst., Tokyo. Div. of Large Tokamak Development.

STUDY OF HELICAL MODULATION IN THE DOUBLET DOUBLET PLASMA COLUMN. DOUBLET 3 EXPERIMENTAL REPORT, 4

T. Sugawara (Toshiba Electric Co.), Noboru Fujisawa, Michiya Shimada, Gary L. Jahns (General Atomic Co.), Hideaki Yokomizo, Masayoshi Magami, Kimihiro Loki (Mitsubishi Atomic Power Industry), and Akio Kitsunezaki Nov. 1980 11 p refs
(DE81-700012; JAERI-M-9180) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Helical modulation of the m = 1 mode was observed in soft X-ray emissions from circular plasma in doublet 3. The emission profile exhibits the peak displaced from the unperturbed axis in the central region. S.L.

N82-24109# Japan Atomic Energy Research Inst., Tokyo. Div. of Thermonuclear Fusion Research.

TOROIDAL DRIFT WAVE

T. Tsuda, Kimitaka Ito, and Sanae Ito (Hiroshima Univ.) Dec. 1980 16 p refs In JAPANESE; ENGLISH summary
(DE81-700017; JAERI-M-9234) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Toroidal effects on the electrostatic drift wave in a sheared magnetic field were investigated by using not only a strong coupling method but also a variational method. The conditions of wave damping due to the magnetic shear are shown. It was found that, in usual Tokamak plasmas, unstable fluctuations have the same localization width both in radial and poloidal directions. DOE

N82-24110# Japan Atomic Energy Research Inst., Tokyo. Div. of Large Tokamak Development.

ACCUMULATION AND ELIMINATION OF METAL IMPURITIES NEAR THE CENTER OF DEE PLASMAS IN DOUBLET 3. DOUBLET 3 EXPERIMENTAL REPORT, 3

N. Fujisawa, Shigeru Konoshima, Masayuri Nagami, Shogo Seki, Hideari Yokomizo, Michiya Shimada, Gary L. Jahns (General Atomic Co.), Seiki Ejima (General Atomic Co.), Richard Groebner (General Atomic Co.), and Neil H. Brooks (General Atomic Co.) Nov. 1980 17 p refs
(DE81-700011; JAERI-M-9179) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Impurity accumulations are observed near the center of the dee shaped plasma in doublet. The accumulation causes remarkable changes in the current profile. This tendency to accumulate is counteracted by MHD activities. DOE

N82-24111# Flinders Univ., Bedford Park (Australia). School of Physical Sciences.

NONLINEAR EXCITATION OF MAGNETOACOUSTIC OSCILLATIONS BY MEANS OF AN OSCILLATING AXIAL CURRENT

I. R. Jones and M. I. Sawley Oct. 1980 25 p refs
(FUPH-R-170) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The nonlinear excitation of magnetoacoustic oscillations of a magnetized plasma column by means of an oscillating axial current is described. These oscillations occur at the second harmonic of the axial current. A suitable choice of plasma parameters and excitation frequency leads to the usual resonant behavior of the oscillations. DOE

N82-24112# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

CONFINEMENT AND RELATED TRANSPORT IN EXTRAP GEOMETRY. RESEARCH AND TRAINING PROGRAMME ON CONTROLLED THERMONUCLEAR FUSION AND PLASMA PHYSICS (EUR-NE)

M. Tendler Dec. 1980 25 p refs Sponsored by Euratom
(TRITA-PFU-81-05; ISSN-0348-7644) Avail: NTIS HC A02/MF A01

The properties of plasma equilibrium are investigated for Extrap magnetic confinement geometry. An analytic solution for the profiles of the plasma parameters is found under the assumption that the energy is lost primarily in the radial direction by heat conduction and convection. The radial particle confinement time is estimated, showing favorable scaling with plasma density and temperature. The conventional assumption of a uniform current density is shown to be unjustified in the case of inhomogeneus electron temperature. An analytical expression is given for the pinch radius with different mechanisms of heat transport. Author (ESA)

N82-24113# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

PLASMA CONFINEMENT IN A SCREW PINCH WITH ELONGATED CROSS SECTION Thesis - Utrecht Univ.

E. J. M. vanHeesch Nov. 1981 68 p refs Sponsored by Euratom and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-81-138) Avail: NTIS HC A04/MF A01

A toroidal plasma was investigated through equilibrium equations. The effect on beta of vertically elongating the plasma cross section inside a quartz torus with a racetrack cross section was investigated. A diamagnetic loop, vertical and horizontal magnetic probes, an He Ne interferometer, a set of pickup coils, and a streak camera diagnosed plasma behavior. Analytic equilibrium calculations and experimental results show that force-free currents largely increase the attainable compression ratios of an elongated, magnetically closed geometry. Author (ESA)

N82-23362*# Princeton Univ., N. J. Plasma Physics Lab.

THE DEVELOPMENT OF A UNIVERSAL DIAGNOSTIC PROBE SYSTEM FOR TOKAMAK FUSION TEST REACTOR

Richard Mastronardi, Richard Cabral, and Dennis Manos *In* NASA. Kennedy Space Center The 16th Aerospace Mech. Symp. May 1982 p 265-275 Prepared in cooperation with American Science and Engineering, Inc., Cambridge, Mass. (For primary document see N82-23344 14-31)
Avail: NTIS HC A15/MF A01 CSCL 20I

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N82-24114# Oregon State Univ., Corvallis.

DEFECTS AND TRANSPORT PROPERTIES IN In(1-x)Ga(x)As(y)P(1-y) AND Ga(1-x)Al(x)As Ph.D. Thesis

Joseph Weiyeh Ku 1982 149 p
Avail: Univ. Microfilms Order No. 8126230

The electrical and optical properties of the III-V semiconductor alloys In(1-x)Ga(x)As(y)P(1-y) and Ga(1-x)Al(x)As, grown by liquid phase (LPE) and vapor phase epitaxial techniques, were investigated by different measurement techniques. Several electron and hole traps, with activation energies varying from 0.26 to 0.82 eV, were detected in In(1-x)Ga(x)As(y)P(1-y) by transient capacitance and photocapacitance measurements. The density and capture cross section of the traps were measured. The temperature dependence of the Hall mobility and carrier concentration were measured as a function of crystal composition. Analysis of the mobility data has yielded values of several transport parameters, including the alloy scattering potential, as a function of composition. The electrical properties of nonintentionally doped LPE Ga(1-x)Al(x)As are dominated by nonshallow defect levels which behave as eletron trapping centers. Optical lineshape, thermally stimulated capacitance, and Hall measurements have been performed to investigate and understand the existing differences between the properties of these defects and similar defects reported to be present in intentionally doped crystals.
Dissert. Abstr.

N82-24115# Delaware Univ., Newark.
OPTICAL PROPERTIES OF HYDROGENATED AMORPHOUS SILICON Ph.D. Thesis
Fernando Alvarez 1981 154 p
Avail: Univ. Microfilms Order No. 8128337

Doping of amorphous materials, like sputtered germanium or silicon was studied. The difficulty of moving the Fermi level was a barrier to the development of amorphous materials. This difficulty is due to the large amount of intrinsic defects which prevented small amounts of impurities to cause large changes in the conductivity of these materials. The discovery that incorporation of hydrogen greatly reduces the density of electronic states in the gap (using glow discharge technique) made amorphous silicon an important semiconductor. Photoluminescence, photoconductivity, absorption in the visible, near and far infrared, electric field quenching, annealing effects, lifetime decay on hydrogenated amorphous silicon were studied, in order to correlate those properties with the electronic properties.
Dissert. Abstr.

N82-24116# Minnesota Univ., Minneapolis.
SINGLE-PARTICLE AND PAIR TUNNELING STUDIES OF SUPERCONDUCTING COMPOUNDS AND TWO-DIMENSIONAL FILMS Ph.D. Thesis
Robin Harold Cantor 1981 174 p
Avail: Univ. Microfilms Order No. 8125940

A procedure using superconducting quantum interferometry was proposed to detect the disappearance of quasi-long-range order at the Kosterlitz-Thouless transition and to determine in a static fashion the temperature dependence of the transverse penetration depth whose value at the transition should reflect the universal jump in the superfluid density. The results of measurements using this technique on granular aluminum thin films are presented. In addition, the application of this technique to study ultra-thin, single crystal aluminum films is discussed. Theories of proximity-effect tunneling are briefly reviewed and are used to make a determination of the energy gap parameter lambda for V3Si. Thin film samples of ErRh4B4 were prepared and magnetic field measurements were taken. It was found from these measurements that the perpendicular critical field is larger than the parallel critical field. Dissert. Abstr.

N82-24117# Washington State Univ., Pullman.
ULTRA HIGH VACUUM STUDIES OF THE INTERACTION OF CARBON MONOXIDE WITH SMALL SUPPORTED METAL PARTICLES Ph.D. Thesis
Dale Larry Doering 1981 96 p
Avail: Univ. Microfilms Order No. 8129965

Particles of Ni and Pd were grown by vapor deposition onto UHV-cleaved and heat treated mica with particle sizes ranging from 1 to 10 nm. Results show that CO interacts with the small particles of the metals differently than with large single crystals. CO is found to decompose on both Ni and Pd particles at a rate which increases with diminishing particle size. The decomposition leaves a carbon residue on the surface which inhibits the adsorption of CO on both metals and in the case of Pd inhibits the rate of the CO oxidation reaction. Surface carbon strongly inhibited the CO oxidation reaction. After the removal of carbon from Pd, both the CO desorption peak area and the CO oxidation reaction rate nearly recover to the levels for the clean sample. Carbon was removed from Ni by the associative desorption of CO from C and O atoms. The temperature of this desorption peak was dependent on the oxygen coverage, but not on the carbon coverage. Dissert. Abstr.

N82-24118# New York Univ., N. Y.
THE EFFECTS OF RARE-EARTH IMPURITIES ON THE MAGNETOTRANSPORT PROPERTIES OF NOBLE METALS Ph.D. Thesis
Graciela La .ueva 1981 96 p
Avail: Univ. Microfilms Order No. 8127928

The transport properties of noble metals with rare earth impurities are considered. Expressions are derived for the magnetoresistance and extraordinary Hall effect in terms of scattering matrix elements of the conduction electron-local moment interaction by using a variational method. The scattering matrix elements are evaluated by using a 5d virtual bound state (vbs) model for the conduction electron in the vicinity of the impurity. The quadrupolar terms in this interaction produce the observed anisotropic behavior of the magnetoresistance. By taking into account the spin orbit coupling of the conduction electron, an expression for the Hall resistivity is obtained which reproduces well the experimental data. Models with and without crystal field splitting on the conduction electron vbs are discussed. Expressions are calculated for the g-shift and resonance linewidth for ESR in these materials. Dissert. Abstr.

N82-24119# Yale Univ., New Haven, Conn.
HYDROGEN SURFACE CONTAMINATION IN THE STORAGE OF ULTRA-COLD NEUTRONS Ph.D. Thesis
Paul Henry LaMarche 1981 108 p
Avail: Univ. Microfilms Order No. 8125685

The desorption and adsorption properties of hydrogen on surfaces in the context of extending the storage time of ultracold neutrons is studied. The technique used to measure the hydrogen concentration employs a resonance in the nuclear cross section of H(-N-15, alpha gamma) C-12. The width of the first resonance of this reaction is 0.3 + or - 0.1 keV in the rest frame of the N-15. At pressures of one million Torr it is possible to reduce the surface concentration to the level of several monolayers using either glow discharge sputtering in oxygen or heating to high temperaures (one thousand c). Attempts to replace hydrogen with deuterium and to bury the hydrogen under evaporated layers were not as succussful. Hydrogen was described at these pressures by high temperature heating and the rate at which it readsorbs was measured. If the heating is severe enough to evaporate the surface of the material, the apparent rate of readsorption is greatly reduced. Dissert. Abstr.

N82-24120# Central Research Inst. for Physics, Budapest (Hungary).
MONTE CARLO STUDY OF SU SUB 2 GAUGE THEORY AT FINITE TEMPERATURE
J. Kuti, J. Polonyi, and K. Szlachanyi Sep. 1980 16 p refs (KFKI-1980-67) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libararies

Numerical evidence for the phase transition between the confinement phase and free Coulomb phase of SU(2) Yang-Mills theory with lattice cut-off is given. The search for the critical temperature is based on a Monte Carlo study of the string tension between a heavy Q anti Q-pair in heat bath. The arbitrary normalization 0.2 GeV(2) is used for the string tension at zero temperature when a smooth extrapolation of the lattice theory to the continuum limit is carried out. The numerical estimate for the critical temperature T sub c approximately 160 + or - 30 MeV in the absence of quark degrees of freedom is given. It is suggestive that the phase transition is of second-order.DOE

N82-24121# Science Research Council, Chilton (England).
THE CAMBRIDGE CRYSTALLOGRAPHY SUBROUTINE LIBRARY. EXTENDED MARK 2 USERS MANUAL
P. J. Brown and J. C. Matthewman 1981 117 p
(PB82-132044; RL-81-063) Copyright. Avail: NTIS HC A06/MF A01 CSCL 20B

Mark II of the Cambridge Crystallography Subroutine Library (CCSL) is a set of FORTRAN subroutines which can be used for standard crystallographic calculations. It is available on the DEC10 system at ILL Grenoble, on the IBM systems at Cambridge University and at the Rutherford Laboratory, and on the CDC system at CEN Saclay. This extended manual is an amalgamation of the original CCSL Mark II Manual of August 1977 (RL-78-010/C, or 77BR155T), and its Supplement No. 1 (also RL-78-010/C). It describes the original Mark II system, extended to include facilities for conventional least squares refinement. Several other routines was added. The major change to the Manual is the addition of a chapter which describes the least squares facilities. Other sections which were dated are: the classified list of routines, the description of crystal data cards, the description of labelled common and the list of subroutines and names used in COMMON. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N82-24122# California Univ., Berkeley.
MIXED STATE QUANTUM BEATS BY STARK SWITCHING Ph.D. Thesis
Jeffrey Alan Kash 1981 177 p
Avail: Univ. Microfilms Order No. 8200158

A class of transient quantum beat effects is investigated. The effects arise when the internal Hamiltonian of a system with coupled degrees of freedom is suddenly changed while resonant radiation is simultaneously being applied. Calculation of the effects uses the sudden approximation of quantum mechanics. The sudden change in the Hamiltonian causes a rotation of the axis of quantization of the system. The new eigenstates are linear combinations of the previous eigenstates. The new eigenstates are in coherent superposition states as a result of the sudden change, and these superposition states modulate of reduce the resonant radiation re-emitted by the system. Dissert. Abstr.

N82-24123# California Univ., Berkeley.
THERMODYNAMICS OF GEOTHERMAL FLUIDS Ph.D. Thesis
Pamela Sue Zukas Rogers 1981 249 p
Avail: Univ. Microfilms Order No. 8200253

A model to predict the thermodynamic properties of geothermal brines, based on a minimum amount of experimental data on a few key systems, was tested. Volumetric properties of aqueous sodium chloride, taken from the literature, are represented by a parametric equation over the range 0 C to 300 C and 1 bar to 1 kbar. Density measurements at 20 bar needed to complete the volumetric description also are presented. The pressure dependence of activity and thermal properties, derived from the volumetric equation, were used to complete an equation of state for sodium chloride solutions. A flow calorimeter used to obtain heat capacity data at high temperatures and pressures is described. Heat capacity measurements from 30 C to 200 C and 1 bar to 200 bar are used to derive values for the activity coefficient and other thermodynamic properties of sodium sulfate solutions as a function of temperature. Literature data on the solubility of gypsum in mixed electrolyte solutions was used to evaluate model parameters for calculating gypsum solubility in seawater and natural brines. Predictions of strontium and barium sulfate solubility in seawater are also given.
Dissert. Abstr.

N82-24124# Association Euratom-CEA, Grenoble (France). Dept. de Recherches sur la Fusion Controlee.
LOWER HYBRID HEATING DATA ON THE WEGA EXPERIMENT REVISITED USING ION STOCHASTIC HEATING AND ELECTRON LANDAU DAMPING THEORIES
C. Gormezano, W. Hess (Max-Planck-Institut fuer Plasmaphysik Garching), C. Ichtchenko, R. Magne, T. K. Nguyen, G. W. Pacher, H. D. Pacher (Max-Planck-Institut fuer Plasmaphysik Garching), F. Soeldner (Max-Planck-Institut fuer Plasmaphysik Garching), G. Tonon, and J. G. Wegrowe (Max-Planck-Institut fuer Plasmaphysik Garching) Jul. 1980 83 p refs
(EUR-CEA-FC-1045) Avail: NTIS (US Sales Only) HC A05/MF A01; DOE Depository Libraries

The already obtained data on the Wega Tokamak by lower hybrid heating (f = 500 MHz - Psub(HF) = 130 KW) are revisited in the light of recent theories on ion stochastic heating and quasi-linear electron Landau damping. It is possible to correctly estimate with these theories the fast ion mean energy, the H.F. power density coupled to the ions and that coupled to the electrons. The values of the parallel index of refraction, N sub (//), which are necessary to obtain a good quantitative agreement between experiment and theoretical estimates, are the same for the ions and for the electrons, even though at higher values than expected. DOE

N82-24125# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. for Theoretical Physics.
ASYMPTOTIC BEHAVIOUR OF FORM FACTORS
M. Bordag (Leipzig Univ.), B. Doerfel (Humboldt Univ.), D. Robaschik, and E. Wieczorek (Inst. fuer Hochenergiephysik Zeuthen) 1980 16 p refs Submitted for publication
(JINR-E-2-80-475) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

An identity for the renormalized current operator is proved by the double renormalization method. The identity brings about a nonlinear relationship for a form factor and a new renormgroup equation for the form factor, where the external momenta are fixed at the renormalization point. These equations are applied to the PHI sub ((6) sup(3) theory and the electromagnetic form factor of quarks in quantum chromodynamics. In the last case, the one-loop approximation gives the leading behavior exp(-C lnln(-g(2))ln(-g(2))). If the leading logarithmic terms (gsup(2)-lnsup(2) (-qsup(2))sup(n)) are extracted from this result, then the behavior exp(-g(2)Cln(2) (-g(2))) is obtained. Whereas the first result is modified by contributions from the two-loop calculations, the result concerning the leading logarithmic terms does not change. DOE

N82-24126# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
FEYNMAN MAPS WITHOUT IMPROPER INTEGRALS
P. Exner and G. I. Kolerov 1980 25 p refs
(JINR-E-2-80-636) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The Feynman maps introduced first by Truman are examined. The domain considered consists of the Fresnel-integrable functions in the sense of Albeverio and Hoegh-Krohn. The original definition of the F-maps is slightly modified: it is started from the underlying measures on the Hilbert space of paths in order to avoid use of improper integrals. Some new properties of the F-maps are derived. In particular, the dominated convergence theorem is shown to be not valid for the F1-map (or Feynman integral); this fact is of a certain importance for classical limit of quantum mechanics. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N82-24127# Pattern Analysis and Recognition Corp., Rome, N. Y.
SABERS: STAND-ALONE ADIC BINARY EXPLOITATION RESOURCES SYSTEM, VOLUME 3 Final Technical Report, Apr. 1978 - Jan. 1981
Albert J. Franklin, Randy L. Caldwell, Scott Cole, Thomas L. McGibbon, Kathy H. Michel, and James R. Wilson Griffiss AFB, N.Y. RADC Sep. 1981 367 p refs 3 Vol.
(Contract F30602-78-C-0078; AF Proj. 1955)
(AD-A110273; RADC-TR-81-250-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 09/2

Computer system operations are presented. Programming support information is provided. Emphasis is given to graphics applications. N.W.

N82-24128*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY, FISCAL YEAR 1982

1982 179 p
(NASA-TM-84415; NAS 1.15:84415) Avail: NTIS HC A09/MF A01 CSCL 05A

A compilation of summary portions of each of the Research and Technology Objectives and Plans (RTOPS) used for management review and control of research currently in progress throughout NASA is presented. Subject, technical monitors, responsible NASA organization, and RTOP number indexes are included. R.J.F.

N82-24129# Pattern Analysis and Recognition Corp., Rome, N. Y.
SABERS: STAND-ALONE ADIC BINARY EXPLOITATION RESOURCES SYSTEM, VOLUME 1 Final Technical Report, Apr. 1978 - Jan. 1981
Albert J. Franklin, Randy L. Caldwell, Scott Cole, Thomas L. McGibbon, Kathy H. Michel, and James R. Wilson Griffis AFB, N.Y. RADC Sep. 1981 120 p 3 Vol.
(Contract F20602-78-C-0078; AF Proj. 1955)
(AD-A110271; RADC-TR-81-250-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

SABERS software architecture is discussed. The interprocess communications mechanism is presented. Data bases and data files are discussed. Graphics applications are explained. N.W.

N82-24130# Pattern Analysis and Recognition Corp., Rome, N. Y.
SABERS: STAND-ALONE ADIC BINARY EXPLOITATION RESOURCES SYSTEM, VOLUME 2 Final Technical Report, Apr. 1978 - Jan. 1981
Albert J. Franklin, Randy L. Caldwell, Scott Cole, Thomas L. McGibbon, Kathy H. Michel, and James R. Wilson Griffiss AFB, N.Y. RADC Sep. 1981 297 p 3 Vol.
(Contract F30602-78-C-0078; AF Proj. 1955)
(AD-A110272; RADC-TR-81-250-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 09/2

Terminal operating procedures are enumerated. System commands are explained. Interactive processing is discussed. N.W.

N82-24131# KG Associates, Dallas, Tex.
LIFE CYCLE COST WORKBOOK Final Report
J. W. Griffith Sep. 1981 34 p refs Sponsored in part by NBS and Dept. of Health and Human Services
(PB82-120510; NBS-GCR-79-186-1) Avail: NTIS HC A03/MF A01 CSCL 05A

A methodology to compare total or relative (Life Cycle) cost of alternative plans is presented. It is designed to be useable by any person who has access to the necessary financial data and a rudimentary understanding of normal business financing and cost. The approach used is based on the completion of simple work sheets. All of the definitions and reference tables needed to execute the work sheets are included in the workbook. By use of this approach the health care provider, or other person responsible for making preliminary decisions among widely varying alternatives, can extend his information base beyond the traditional approach of first cost figures to consider the actual life cycle price. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N82-24132* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY, SECTION 1
Jan. 1982 60 p 2 Vol.
(NASA-SP-7039(20)-Sect-1; NAS 1.21:7039(20)-Sect-1) Avail: NTIS HC $15.00 CSCL 05B

Abstracts are cited for 165 patents and patent applications introduced into the NASA scientific and technical information system during the period July 1981 through December 1981. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or patent application. A.R.H.

N82-24133* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY, A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jan. 1982 700 p 2 Vol.
(NASA-SP-7039(20)-Sect-2; NAS 1.21:7039(20)-Sect-2) Avail: NTIS HC $15.00 CSCL 05B

Entries for approximately 4000 citations for the period May 1969 through Decenber 1981 are listed. Subject, inventer, source, number, and accession number indexes are included. A.R.H.

N82-24134*# California Univ., Santa Barbara. Geography Remote Sensing Univ.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FUNDAMENTAL RESEARCH PROGRAM. INFORMATION UTILIZATION AND EVALUATION, APPENDICES Final Report
John E. Estes and Ludwig Eisgruber 1 Jun. 1981 132 p refs Prepared in cooperation with Oregon State Univ., Corvallis
(Contract NAS9-16077)
(NASA-CR-167591; NAS 1.26:167591) Avail: NTIS HC A17/MF A01 CSCL 05B

Important points presented and recommendations made at an information and decision processes workshop held in Asilomar, California; at a data and information performance workshop held in Houston, Texas; and at a data base use and management workshop held near San Jose, California are summarized. Issues raised at a special session of the Soil Conservation Society of America's remote sensing for resource management conference in Kansas City, Missouri are also highlighted. The goals, status and activities of the NASA program definition study of basic research requirements, the necessity of making the computer science community aware of user needs with respect to information related to renewable resources, performance parameters and criteria for judging federal information systems, and the requirements and characteristics of scientific data bases are among the topics reported. A.R.H.

N82-24135*# California Univ., Santa Barbara.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FUNDAMENTAL RESEARCH PROGRAM. INFORMATION UTILIZATION AND EVALUATION Final Report
John E. Estes and Ludwig Eisgruber 1 Jun. 1981 33 p refs Prepared in cooperation with Oregon State Univ., Corvallis
(Contract NAS9-16077)
(NASA-CR-167592; NAS 1.26:167592) Avail: NTIS HC A03/MF A01 CSCL 05B

In the second half of the 1980's NASA can expect to face difficult choices among alternative fundamental and applied research, and development projects that could potentially lead to improvements in the information systems used to manage renewable resources. The working group on information utilization and evaluation believes that effective choices cannot be made without a better understanding of the current and prospective problems and opportunities involved in the application of remote sensing to improve renewable research information systems. A renewable resources information system is defined in a broad context to include a flow of data/information from: acquisition through processing, storage, integration with other data, analysis, graphic presentation, decision making, and assessment of the affects of those decisions. A.R.H.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N82-24136# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR FISCAL YEAR 1983
Fuqua Washington GPO 1982 224 p Rept. to accompany H.R. 5890 presented by the Comm. on Sci. and Technol. at the 97th Congr., 2d Sess., 5 May 1982
(GPO-89-006; H-Rept-97-502) Avail: US Capitol, House Document Room

Federal budget appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, research and program management, and other purposes are explained. A brief description of project activities is included. L.F.M.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N82-24137*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
RESEARCH AND TECHNOLOGY ANNUAL REPORT FY-1981
Nov. 1981 100 p
(NASA-TM-84199; NAS 1.15:84199) Avail: NTIS HC A05/MF A01 CSCL 05A

Space transportation systems are summarized: space shuttle enhancement, a space operations center, the space platform, and geostationary activites are discussed. Aeronautics and space technology are summarized: experiments, energy systems, propulsion technology, synthetic aperture radar, large space systems, and shuttle-launched vehicles are discussed. Space sciences are summarized: lunar, planetary, and life sciences are discussed. Space and terrestrial applications are summarized. The AgRISTARS program, forest and wildland resource, and Texas LANDSAT applications are discussed. N.W.

N82-24138# Committee on Science and Technology (U. S. House).
INNOVATION IN THE BASIC MATERIALS INDUSTRIES. PROCEEDINGS OF THE SIXTH ANNUAL ENGINEERING FOUNDATION CONFERENCE ON MATERIALS POLICY
Washington GPO Jun. 1981 586 p refs Rept. presented to the Comm. on Sci. and Technol., 97th Congr., 1st Sess., Jun. 1981 Conf. held in Henniker, N.H., 27 Jul. - 1 Aug. 1980 Prepared by Congressional Research Service, Library of Congress
(GPO-80-527) Avail: Committee on Science and Technology

The need for initiatives in promoting technological innovation in the basic materials was considered. Special emphasis was placed upon developing ideas on ways industries can contribute inputs to such issues as investment policy, tariff regulations, capitalization, and environmental control that affect government-industry relations in the areas of materials and technological innovation. J.D.

N82-24139# Purdue Univ., Lafayette, Ind. Automotive Transportation Center.
OPPORTUNITY AND RISK ASSESSMENT (OPRA 1980). ELECTRIC AND HYBRID VEHICLES: STRATEGIC ISSUE FOR THE 1980S Final Report
Oct. 1981 219 p refs
(Contract DE-AS02-77CS-54250; EPRI Proj. 1524-1)
(DE82-003121; EPRI-EM-2068) Avail: NTIS HC A10/MF A01

The national strategy which might be followed by the Department of Energy and the Electric Power Research Institute (EPRI) in fostering the acceptance of these technologies is presented. The assessment is based on a set of national objectives on which an electric and hybrid vehicle stragegy could be based. It raises issues based on the state of the art of these technologies and their potential use, and examines alternative strategies which might resolve the issues. The opportunities, risks, and recommendations are synthesized based on this process. The recommmendations are to initiate a focused information program, to strengthen electric vehicles, to establish and rationalize financial incentives, to evolve the present DOE market demonstration program into a program of large scale market and technology tests, and to develop government and utility markets for research and development. For each of these recommendations, joint, coordinated programs among industry, government, and utility participants are stressed. It is envisioned that EPRI might play a pivotal role in fostering such programs. DOE

N82-24140# Tennessee Valley Authority, Chattanooga. Transportation Projects Office.
EPRI/TVA PILOT ELECTRIC VEHICLE DEMONSTRATION PROJECT, PHASE 1 Progress Report
T. E. Hundley and C. R. Furman Oct. 1981 119 p
(EPRI Proj. 1136-5)
(DE82-900977; EPRI-EM-2095) Avail: NTIS HC A06/MF A01

A pilot electric vehicle demonstration project is reported. The following aspects of the project are presented: vehicle selection and acquisition; vehicle operations; data acquisition systems; early results; and project plans are presented. Ten transporters with electric propulsion systems were acquired and are currently being used in the initial test and evaluation. Vehicle operating data in a real world utility environment is recorded by two different data acquisition systems, and processed with a minicomputer. DOE

88 SPACE SCIENCES (GENERAL)

N82-24141*# National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1980-1981
Joseph M. Boyce Apr. 1982 85 p
(NASA-TM-84468; NAS 1.15:84468) Avail: NTIS HC A05/MF A01 CSCL 03B

A compilation of selected bibliographic data (600 citations) specifically relating to recent publications submitted by principal investigators and their associates on planetary geology is given. R.J.F.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N82-24142# California Univ., Berkeley.
SPECTRAL EVOLUTION OF GALAXIES Ph.D. Thesis
Gustavo Ramon Bruzual-Alfonzo 1981 481 p
Avail: Univ. Microfilms Order No. 8200037

Models for the spectral evolution of galaxies are developed using population synthesis techniques. Different choices of the initial mass function and the star formation rate allow the construction of models which at the present epoch cover the range of observed galaxy spectra. Special emphasis is given to the ultraviolet region of the spectrum. Ultraviolet spectra of late type stars and early type galaxies obtained with the International Ultraviolet Explorer satellite are presented. The evolving spectral energy distributions are used to compute galaxy colors, magnitudes, k-corrections, and evolutionary corrections as functions of redshift for different photometric systems. Faint galaxy counts as a function of apparent magnitude and the contribution of these galaxies to the extragalactic background light as a function of wavelength are also modeled and compared to current observations. Predictions are presented for galaxy counts as a function of apparent magnitude, and surface brightness profiles as a function of redshift. Dissert. Abstr.

N82-24143*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE AGK3-BD AND BD-AGK3 CROSS-INDEX CATALOGUES
Wayne H. Warren, Jr. Jan. 1982 13 p refs
(NASA-TM-84172; NSSDC/WDC-A-R/S-82-06; NAS 1.15:84172) Avail: NTIS HC A02/MF A01 CSCL 03A

The machine-readable cross identification catalogs were prepared by extracting AGK3 and BD numbers from the magnetic tape version of the AGK3 Catalog. After preparation of the AGK3-BD file, which contains all stars in the AGK3 catalog, the file was sorted according to BD number and rearranged so that the BD number occurs at the beginning of each record. During the sorting operation, all AGK3 stars having no BD numbers were omitted. The BD-AGK3 file is especially useful for finding BD stars in the AGK3 catalog, since precession has moved stars across declination boundaries and it often was necessary to examine more than one AGK3 zone to locate a BD star in the catalog. The contents of the cross index files is described so that users can read and process the tape without problems, guesswork, or consulting the parent catalog. J.M.S.

N82-24144*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOCUMENTATION FOR THE MACHINE-READABLE VERSION OF A DEEP OBJECTIVE-PRISM SURVEY FOR LARGE MAGELLANIC CLOUD MEMBERS
Wayne H. Warren, Jr. Feb. 1982 14 p refs
(NASA-TM-84173; NSSDC/WDC-A-R/S-82-07; NAS 1.15:84173) Avail: NTIS HC A02/MF A01 CSCL 03A

This catalog contains 1273 proven or probable Large Magellanic Cloud (LMC) members, as found on deep objective-prism plates taken with the Curtis Schmidt telescope at Cerro Tololo Inter-American Observatory in Chile. The stars are generally brighter than about photographic magnitude 14. Approximate spectral types were determined by examination of the 580 A/mm objective-prism spectra; approximate 1975 positions were obtained by measuring relative to the 1975 coordinate grids on the Uppsala-Mount Stromlo Atlas of the LMC (Gascoigne and Westerlund 1961), and approximate photographic magnitudes were determined by averaging image density measures from the plates and image-diameter measures on the 'B' charts. The machine-readable version of the LMC survey catalog is described to enable users to read and process the tape file without problems or guesswork. J.M.S.

N82-24145# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES REPORT OF THE INSTITUTE OF ASTRONOMY] Annual Report, 1980-1981
1981 45 p refs
Avail: NTIS HC A03/MF A01

Research into stars (including binaries) star clusters, stellar dynamics, galactic structure and evolution, cosmology, quasars, active galaxies, and theoretical high energy astrophysics is reported. An automated photographic measuring system was instituted. Author (ESA)

N82-24146# Royal Observatory, Edinburgh (Scotland).
SPECTROPHOTOMETRY OF COOL STARS IN THE NEAR INFRARED. PART 5: RESULTS FOR A REGION IN MONOCEROS
F. Smriglio (Rome Univ.) and K. Nandy 1981 16 p refs
(ROE-OR-6; ISSN-0309-099X) Avail: NTIS HC A02/MF A01

Spectral types and IR magnitudes of M stars brighter than V = 15 (m) were obtained for a galactic region of 21.5 sq deg in the direction of Monoceros. The classification is based on the relative strengths of molecular bands visible in the near infrared in low dispersion objective prism spectra. The space distribution of M stars in this direction shows a correlation with spiral arm structure as outlined by other spiral arm tracers. Author (ESA)

N82-24147# Royal Observatory, Edinburgh (Scotland).
SPECTROPHOTOMETRY OF COOL STARS IN THE NEAR INFRARED. PART 6: RESULTS FOR A REGION IN THE DIRECTION OF CEPHEUS
F. Smriglio (Rome Univ.) and K. Nandy 1981 18 p refs
(ROE-OR-7; ISSN-0309-099X) Avail: NTIS HC A02/MF A01

Infrared magnitudes and spectral types of M and C stars brighter than I = 13 (m) were obtained for a region of 18 sq deg in the direction of Cepheus. The spectral classification is based on the relative strengths of the TiO bands visible in the IR low dispersion objective prism spectra. The observed space distribution of early stars shows a good correlation with the galactic spiral features as revealed by the traditional spiral tracers, but the stars later than M4 are evenly distributed in arm and interarm regions. The space densities of M2-M4 stars are asymmetrical with respect to the galactic equator, which appears also in the distribution of OB stars, and supergiants. Author (ESA)

N82-24148# Texas Univ. at Arlington.
LUMINOSITY FUNCTIONS OF BRIGHT RED GIANT STARS IN GLOBULAR CLUSTERS Ph.D. Thesis
Elizabeth Melton Green 1981 319 p
Avail: Univ. Microfilms Order No. 8128631

Globular cluster metallicities, helium abundances, distances, reddenings, and ages are discussed, with emphasis on the interdependence of these quantities, and the assumptions involved in their determination. Luminosity functions are shown to provide valuable and complementary information in the analysis of color/magnitude diagrams. Bolometric luminosity functions constructed from published photometry for large samples of red giant stars in seventeen globular clusters are presented. Selection effects due to completeness, crowding, presence of field stars, and possible systematic photometric trends were minimized. Theoretical luminosity functions were constructed and compared to observed luminosity functions. The relative number of stars at the red giant tip varies significantly from one cluster to another. A variation in the magnitude of the horizontal branch relative to the giant branch is advanced to explain this. Clusters close to the galactic center, including some rather metal rich ones, must have brighter horizontal branches than those of typical metal poor clusters nearer the Sun. Some of the consequences of the implied variations are discussed with regard to distances, metallicities, calibrations of globular cluster properties, and the second parameter problem. Dissert. Abstr.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N82-24149# Arizona Univ., Tucson.
STAR FORMATION IN THE rho OPHIUCHI DARK CLOUD Ph.D. Thesis
Bruce Alan Wilking 1981 160 p
Avail: Univ. Microfilms Order No. 8200323

Sensitive millimeter wave and near infrared observations were performed in the central regions of the rho Ophiuchi dark cloud. High spatial resolution observations of the optically thin C(18)O

emission lines are shown to be free of self absorption. They permit accurate determination of the distribution of molecular gas and allow estimation of the mass and visual extinction in the cloud. A completely sampled near infrared survey of a 105 sq. arcmin area which encloses the region of highest visual extinction revealed twenty objects. It is shown that these objects are young stars embedded in the cloud. Comparing these observations with existing radio and infrared data, a detailed study of the energetics and star formation process within the cloud was made. It is included that the high temperatures of the molecular gas cannot be due to collisions with warm dust. The feasibility of alternate heat sources such as cosmic-ray ionization, shocks, and the distortion of magnetic fields are discussed. Dissert. Abstr.

N82-24150# California Univ., Berkeley.
SWIRLING GAS FLOWS IN ELLIPTICAL GALAXIES Ph.D. Thesis
Linda Siobhan Sparke 1981 97 p
Avail: Univ. Microfilms Order No. 8200284

The small specific angular momentum of elliptical galaxies, based on calculations of the flow of slowly rotating gas is examined. Since the system is assumed to revolve slowly, flow over most of the galaxy can be treated by a perturbation method. Equations for the steady axisymmetric flow of isothermal gas are expanded about a spherical flow, in powers of a dimensionless measure of the stellar rotation speed. To first order, angular momentum is convected along radial steamlines without changing the meridional flow. The second order term gives the density distribution, and the extent of the evacuated funnel. Specific models for extragalactic radio sources, based upon these calculated flow patterns, are presented. A perturbation analysis is used to investigate the effects of an almost radial magnetic field on a slowly swirling flow. Dissert. Abstr.

N82-24151# California Univ., Berkeley.
MODEL ATMOSPHERES FOR T TAURI STARS Ph.D. Thesis
Nuria Pilar Calvet-Cuni 1981 145 p
Avail: Univ. Microfilms Order No. 8200044

Model atmospheres for T Tauri stars are presented. These models consist of a normal photosphere with Teff = 4000K and log g = 3.5, and a chromosphere with temperature rising sharply above a minimum to a plateau at T = 6000K and then to another plateau at T = 1000K. The temperature is allowed to increase to 20000K above this second plateau. The photospheric parameters are consistent with those of a large fraction of stars in the Taurus cloud, as indicated by the HR diagram of this group of stars. Several models were calculated with temperature minima at log m = 0.3, 0.0 and -0.52, and the beginning of the 10000K plateau at log m = -1.52, -2.0, -2.3 and -3.0, where m is the mass column density. Line blanketing was included. The results suggest that non-homogeneous models consisting of a photosphere and overlying hot spots are more appropriate for the interpretation of the T Tauri spectra in that they predict a smaller Balmer jump and possibly a larger Mg II k flux. The presence of an extended region contributing to the H alpha emission is also strongly indicated. Dissert. Abstr.

N82-24152# North Carolina State Univ. at Raleigh.
THE APPLICATION OF CARPENTER'S METHOD TO HIGH PRECISION ORBITAL CALCULATION Ph.D. Thesis
LeRoy Elsworth Doggett 1981 126 p
Avail: Univ. Microfilms Order No. 8128521

The solution of the differential equations of the motion of a planet for prescribed intervals of time by Picard iteration with Chebyshev series is described and applied to constructing a semi-analytical theory of Mars for a time span of 2000 days. Using the two body problem, procedures were established for constructing solutions with an internal precision 75 cm over 2000 days. These solutions were efficiently constructed by partitioning the total time span and constructing solutions for each section. It was demonstrated that solutions of the Kustaanheimo-Stiefel equations by Carpenter's method could be constructed more efficiently and accurately than the solutions of the Newtonian equations. The perturbed equations of Mars, with planetary and relativistic pertubations, were solved. A method for solving the perturbed KS equations by Carpenter's method is outlined. Carpenter's method was applied to constructing the matrizant of the two body problem by differencing neighboring orbits. Methods are outlined for the more general case of variations of physical constants in the two body and perturbed problems. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N82-24153*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
RADAR INVESTIGATION OF ASTEROIDS Semiannual Status Report, 1 Nov. 1981 - 30 Apr. 1982
Steven J. Ostro May 1982 13 p
(Grant NAGw-116)
(NASA-CR-168851; NAS 1.26:168851) Avail: NTIS HC A02/MF A01 CSCL 03B

The dual polarization CW radar system which permits simultaneous reception in the same rotational sense of circular polarization as transmitted (i.e., the 'SC' sense) and in the opposite ('OC') sense, was used to observe five previously unobserved asteroids: 2 Pallas, 8 Flora, 22 Kalliope, 132 Aethra, and 471 Papagena. Echoes from Pallas and Flora were easily detected in the OC sense on each of several nights. Weighted mean echo power spectra also show marginally significant responses in the SC sense. An approximately 4.5 standard deviation signal was obtained for Aethra. The Doppler shift of the peak is about 10 Hz higher than that predicted from the a priori trial ephemeris. Calculations are performed to determine whether this frequency offset can be reconciled dynamically with optical positions reported for Aethra. S.L.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N82-24154 Institut d'Aeronomie Spatiale de Belgique, Brussels.
BALLOON OBSERVATIONS OF SOLAR ULTRAVIOLET IRRADIANCE AT SOLAR MINIMUM
P. C. Simon, R. Pastiels, and D. Nevejans 1981 16 p refs Submitted for publication
(Aeronomica-Acta-A-239-1981) Avail: Issuing Activity

Balloon observations of solar irradiance between 200 and 240 nm were performed in 1976 and 1977. Ultraviolet spectra were recorded for different zenith angles at an altitude of 41 km by a spectrometer with a spectral bandpass of 0.4 nm. Solar irradiances at 1 A confirm previous balloon values. Agreement with previous balloon measurements is within + or - 5% between 210 and 240 nm, but at 200 nm the later values are 13% higher. The values adopted beyond 230 nm for photodissociation rate calculations are too high. Discrepancies between measurements prevent long-term variability patterns in solar cycles being established. Author (ESA)

N82-24155 Institut d'Aeronomie Spatiale de Belgique, Brussels.
BALLOON OBSERVATIONS OF SOLAR ULTRAVIOLET IRRADIANCE DURING SOLAR CYCLE 21
P. C. Simon, R. Pastiels, D. Nevejans, and D. Gillotay 1981 14 p refs Presented at Symp. on the Solar Constant and the Spectral Distribution of Solar Irradiance, Hamburg, 17-18 Aug. 1981
(Aeronomica-Acta-A-241-1981) Avail: Issuing Activity

Balloon-borne spectrometric observations were made at 41 km altitude in order to measure solar irradiance from 200 to 240 nm and from 270 to 330 nm. Extraterrestrial solar irradiance values were deduced from the measurements. Quantitative

determinations of solar variabilities are limited by the reproductibility of these observations around 210 nm. Data are compared with previous observations. Systematic divergences appear between most of the measurements due to experimental errors. Differences between all flights are < 12%. Accuracy is + or - 15% at 210 nm and + or - 5% at 300 nm. Author (ESA)

N82-24156# Bern Univ. (Switzerland). Div. of Solar Observations.

FACILITIES AND INSTRUMENTATION FOR SOLAR RESEARCH AT BERN

Dec. 1981 24 p refs

(Rept-46) Avail: NTIS HC A02/MF A01

Microwave polarimeters, data acquisition and processing equipment, and optical observing equipment are described. Observation results are summarized. The polarimeters use heterodyne receivers. With an integration time of 0.1 sec, system temperatures between 500 and 1000 K and antenna beam widths between 1 and 3 deg, solar intensity fluctuations of approximately 0.1% to 0.6% of quiet Sun level can be detected under good atmospheric conditions. A dynamic range of 100 between the maximum unsaturated burst registration and the quiet Sun level is achieved by a fast electronic 10 dB attenuator inserted during very strong events. An electro-optical registration system based on a CCD camera achieves correlation of photographic observations with microwave data on flares. Digital registration simplifies data storage and reduction, allowing interactive computation of parameters such as spectral indices and correlations.

Author (ESA)

N82-24157# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. Environmental Data and Information Service.

SOLAR-GEOPHYSICAL DATA NUMBER 444. PART 1: PROMPT REPORTS. DATA FOR JULY, 1981, JUNE 1981 AND LATE DATA

Helen E. Coffey, ed. Aug. 1981 159 p 2 Vol.

(PB82-124660; SGD-444-Pt-1; NOAA-81092507) Avail: NTIS HC A08/MF A01 CSCL 03B

In addition to an index for 1980-81, this prompt report provides data for July 1981 on: alert periods, daily solar indices, solar flares, solar radio emission, coronal holes, inferred interplanetary magnetic field polarities, mean solar magnetic field, spacecraft observations, and Boulder Geomagnetic Substorm Log. It also provides data for June 1981 on: daily solar activity centers, sudden ionospheric disturbances, spacecraft observations, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. Late data includes cosmic rays May 1981; and geomagnetic indices April 1981. GRA

N82-24158# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. Enviromental Data and Information Service.

SOLAR-GEOPHYSICAL DATA. PART 2: COMPREHENSIVE REPORTS. DATA FOR FEBRUARY 1981 AND MISCELLANEA

Helen E. Coffey, ed. Aug. 1981 68 p refs 2 Vol.

(PB82-124678; SGD-444-Pt-2; NOAA-81092508) Avail: NTIS HC A04/MF A01 CSCL 03B

In addition to an index for 1980-1981, this issue of comprehensive reports provides data for February 1981 on: solar radio emission, solar X-ray radiation and mass ejections from the Sun. A new schedule will cause the daily flare index and the regional flare index to appear 13 and 14 months from the data of observation. This issue also contains miscellaneous data on active regions Oct. 22, 1980 - Feb. 1981 and synoptic solar maps Oct. 22, 1980 - Feb. 9, 1981. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N82-24159# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Sect. d'Astrophysique.

COSMIC RAYS FROM REGIONS OF STAR FORMATION. 2: THE OB ASSOCIATIONS

M. Casse, T. Montmerle, and J. A. Paul Jun. 1980 2 p refs Presented at the 94th Symp. on Origin of Cosmic Rays, Bologna, 11-14 Jun. 1980

(CEA-CONF-5245) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

The question of whether OB associations are detectable high energy gamma ray sources because of the interaction of accelerated particles with the dense molecular cloud still present near young and massive stars was addressed. The three factors that govern the gamma ray visibility of a given OB association are (1) the rate of kinetic energy deposition; (2) the distance of the OB association; and (3) the angular extent of the association. The relative detectability of OB associations as well as of the Wolf-Rayet stars in them was examined. The expected gamma ray surface brightness for the 10 brightness associations, normalized to that of the Carina complex, are tabulated. The large scale correlation between galactic gamma radiation and Lyman continuum of photons is naturally explained as well as the dominance of the spiral structure on the galactic gamma ray emission. A.R.H.

99 GENERAL

N82-24160# Research Inst. of National Defence, Stockholm (Sweden).

INVESTIGATION ON CONVENTIONAL WEAPON PENETRATION AND EXPLOSION POINT DISTRIBUTION IN BUILDINGS [STUDIE AVSEENDE KONVENTIONELLA VAPENS INTRAENGNING OCH EXPLOSIONS-PUNKTSFOERDELNING I BYGGAND]

Lennart Goetherskjoeld Dec. 1981 60 p In SWEDISH

(FOA-C-20435-D4) Avail: NTIS HC A04/MF A01

The penetration of projectiles in buildings was studied, especially for nonvertical incidences. A calculation scheme is presented for the places where the explosion occurs in the building, e.g., in connection with the location of the shelter. A computer program was chosen. The calculation was based on the Monte Carlo method and numerical integration. It is supposed the projectiles are equipped with a retardation device. Results are given for two types of multistory buildings. Author (ESA)

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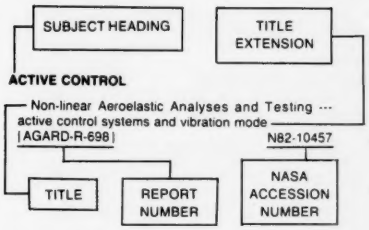
Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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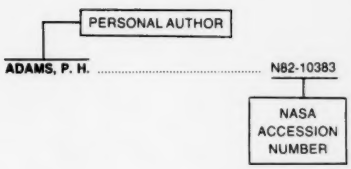

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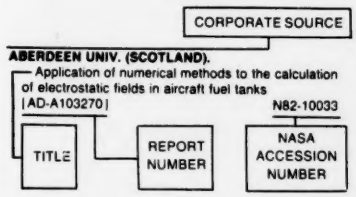

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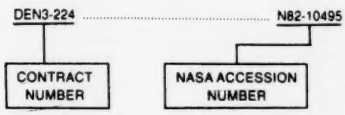

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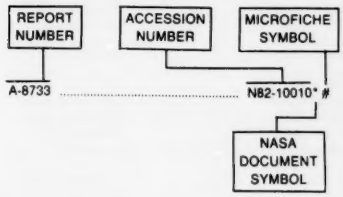

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APR-1 ..... N82-23287 #

AR-82-2 ..... N82-23263* #
AR-002-294 ..... N82-23197 #
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ARB-R-81/148 ..... N82-23822 #

ARL/AERO-NOTE-403 ..... N82-23197 #

ARL/STRUC-REPT-387 ..... N82-23551 #

ARO-15637.12-M ..... N82-24040 #
ARO-15657.4-E ..... N82-23250 #

ATPR-3 ..... N82-23329 #

ATR-82(8459)-1 ..... N82-23285 #

AVRADCOM-TR-81-A-2 ..... N82-24052* #

B-201441 ..... N82-24027 #

BAE-ARG-163 ..... N82-23255 #

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BMFT-FB-T-79-88 ..... N82-23523 #
BMFT-FB-T-81-211 ..... N82-23992 #
BMFT-FB-T-81-214 ..... N82-23812 #
BMFT-FB-T-81-215 ..... N82-23993 #
BMFT-FB-T-81-217 ..... N82-23538 #

BNL-51408 ..... N82-23751 #

BR81702 ..... N82-23190
BR81773 ..... N82-24054 #
BR81972 ..... N82-23795 #
BR81973 ..... N82-23534 #
BR81999 ..... N82-23393
BR82033 ..... N82-23796 #
BR82084 ..... N82-24026
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CAEC-75 ..... N82-23783 #

CBPF-A0012/80 ..... N82-24033 #

CEA-CONF-5245 ..... N82-24159 #

CEA-N-2174 ..... N82-23304 #
CEA-N-2184 ..... N82-23555 #
CEA-N-2187 ..... N82-23797 #
CEA-N-2203 ..... N82-24060 #

CEA-R-5061 ..... N82-23501 #
CEA-R-5075 ..... N82-23502 #

CERN-80-06 ..... N82-24024 #

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CFD/82/2 ..... N82-23299 #
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CM-55 ..... N82-23958 #

CONF-81-226 ..... N82-23684* #
CONF-811046-12 ..... N82-24068 #
CONF-8104107-12 ..... N82-23340 #

CONTRIB-531 ..... N82-23970 #

COO-3459-17 ..... N82-23307 #

CRC-1351-E ..... N82-23383 #
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CRSR-778 ..... N82-24059 #

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CTH-IEFT/PP-1980-20 ..... N82-24089 #

CTH-MATH-1982-2 ..... N82-24036 #

CTR-3-5-77-206-2 ..... N82-23372 #

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DE81-003081 ..... N82-23772 #
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DE81-028681 ..... N82-24061 #
DE81-031986 ..... N82-23269 #
DE81-700005 ..... N82-24090 #
DE81-700008 ..... N82-24089 #
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DE81-700409 ..... N82-23312 #
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DFVLR-FB-81-29 ..... N82-23202 #
DFVLR-FB-81-37 ..... N82-23408 #
DFVLR-FB-82-01 ..... N82-24073 #

DFVLR-MITT-79-08 ..... N82-23232 #
DFVLR-MITT-79-09 ..... N82-23198 #
DFVLR-MITT-79-12 ..... N82-23850 #
DFVLR-MITT-81-15 ..... N82-23529 #
DFVLR-MITT-81-27 ..... N82-23536 #
DFVLR-MITT-81-29 ..... N82-23325 #
DFVLR-MITT-82-01 ..... N82-23560 #

DLR-MITT-81-02 ..... N82-23265 #

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DOC-82SDS010-APP-A ..... N82-24009 #

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DOE/CE-0021 ..... N82-23762 #

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DOE/CS-20212/1 ..... N82-23759 #
DOE/CS-34700/T1 ..... N82-23750 #
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DOE/ER-03459/T1 ..... N82-23307 #
DOE/ER-03948/T1 ..... N82-24061 #
DOE/ER-04178/5 ..... N82-23764 #
DOE/ER-04385/5 ..... N82-23306 #
DOE/ER-10373/1 ..... N82-23292 #
DOE/ER-10507/2 ..... N82-23308 #
DOE/ER-10612/5 ..... N82-23290 #
DOE/ER-40031/T1 ..... N82-24071 #

DOE/ERD-0031 ..... N82-23794 #

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DOE/ET-10159/T8 ..... N82-23328 #
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DOE/ET-29232/T4-VOL-3A ..... N82-23736 #
DOE/ET-29232/T4-VOL-6 ..... N82-23737 #
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DOE/ET-29232/T4-VOL-8 ..... N82-23739 #
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DOE/EV-10506/T2 ..... N82-23805 #
DOE/EV-71005/61 ..... N82-23971 #

DOE/ID-12079/28 ..... N82-23618 #

DOE/JPL-1012-66 ..... N82-23650* #
DOE/JPL-955131-81-2 ..... N82-23774* #

DOE/MA-0004 ..... N82-23734 #

DOE/MC-08341/31-VOL-1-PT-1 ..... N82-23619 #
DOE/MC-08341/31-VOL-1-PT-3 ..... N82-23620 #
DOE/MC-16377/T1 ..... N82-23294 #

DOE/NASA/20320-37 ..... N82-23679* #

DOE/PC-30098/T3 ..... N82-23798 #
DOE/PC-30242/T1 ..... N82-23287 #
DOE/PC-40265/2 ..... N82-23288 #

DOE/PETC-TR-82/1 ..... N82-23286 #

DOE/RA-50138/1 ..... N82-23330 #
DOE/RA-50300/T1 ..... N82-23333 #
DOE/RA-50301/T1 ..... N82-23332 #
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DOE/RA-50345/1-VOL-2 ..... N82-23335 #

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DOE/SF-11439/1-VOL-1 ..... N82-23741 #
DOE/SF-11439/1-VOL-2 ..... N82-23742 #
DOE/SF-11439/1-VOL-3 ..... N82-23743 #
DOE/SF-11495/T1-VOL-1 ..... N82-23765 #
DOE/SF-11495/T1-VOL-2 ..... N82-23766 #

DOE/TIC-4500-REV-69 ..... N82-23516 #
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DOE/TIC-2000234 ..... N82-23763 #
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DP-1594 ..... N82-23293 #

DRIC-T-6496 ..... N82-23534 #
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EEB-VENT-81-15 ..... N82-23807 #

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EPA-450/5-81-002 ..... N82-23819 #
EPA-600/3-81-051 ..... N82-23841 #
EPA-600/9-80-042 ..... N82-23786 #

EPA/AA/CTAB/PA/81-2 ..... N82-23825 #
EPA/AA/CTAB/PA/81-3 ..... N82-23823 #
EPA/AA/CTAB/PA/81-10 ..... N82-23821 #
EPA/AA/CTAB/PA/81-11 ..... N82-23813 #
EPA/AA/CTAB/PA/81-20 ..... N82-23824 #
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EPRI-CS-2111 ..... N82-23535 #

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EPRI-EA-1910-VOL-3 ..... N82-23799 #
EPRI-EA-2048-VOL-1 ..... N82-23801 #
EPRI-EA-2048-VOL-2 ..... N82-23802 #
EPRI-EA-2048-VOL-4 ..... N82-23803 #
EPRI-EA-2048-VOL-6 ..... N82-23804 #
EPRI-EA-2078-VOL-1 ..... N82-23769 #
EPRI-EA-2078-VOL-2 ..... N82-23770 #

EPRI-EL-2018-VOL-1 ..... N82-23400 #
EPRI-EL-2018-VOL-2 ..... N82-23401 #
EPRI-EL-2018-VOL-3 ..... N82-23402 #

EPRI-EM-1589-VOL-8-APP-D ..... N82-23753 #
EPRI-EM-1589-VOL-11 ..... N82-23771 #
EPRI-EM-2068 ..... N82-24139 #
EPRI-EM-2095 ..... N82-24140 #

EPRI-NP-1963 ..... N82-23296 #
EPRI-NP-1971 ..... N82-23556 #
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ERIM-147200-13-F ..... N82-23568* #

ESA-TT-575 ..... N82-24073 #
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EUR-CEA-FC-1049 ..... N82-24045 #
EUR-CEA-FC-1050 ..... N82-23284 #
EUR-CEA-FC-1060 ..... N82-24093 #
EUR-CEA-FC-1074 ..... N82-24046 #
EUR-CEA-FC-1076 ..... N82-24094 #
EUR-CEA-FC-1078 ..... N82-24095 #
EUR-CEA-FC-1087 ..... N82-23403 #
EUR-CEA-FC-1090 ..... N82-24101 #
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EUR-CEA-FC-1099 ..... N82-24067 #
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EW-UI-04119 ..... N82-23564* #

EW-U1-04103 ..... N82-23598* #
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E82-10199 ..... N82-23572* #
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FC-J1-04181 ..... N82-23604* #

FC-LO-00472 ..... N82-23603* #

FC-L1-04096 ..... N82-23579* #
FC-L1-04127 ..... N82-23565* #
FC-L1-04142 ..... N82-23582* #
FC-L1-04145 ..... N82-23595* #
FC-L1-04172 ..... N82-23594* #
FC-L1-04192 ..... N82-23590* #

FC-P1-04197 ..... N82-23588* #

FE-1770-75-VOL-1 ..... N82-23336 #
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FHWA/RD-81/053 ..... N82-23814 #
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FIAS-R-69 ..... N82-24064 #
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FOA-C-20434-E4 ..... N82-23324 #
FOA-C-20435-D4 ..... N82-24160 #
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FOA-C-20438-E1(E2) ..... N82-23959 #
FOA-C-20439-B2(D2) ..... N82-23960 #
FOA-C-30243-A3 ..... N82-23409 #
FOA-C-30245-E ..... N82-23271 #
FOA-C-30248-E ..... N82-23404 #
FOA-C-30249-E4 ..... N82-23530 #
FOA-C-30250-A ..... N82-23405 #
FOA-C-30252-E ..... N82-23406 #
FOA-C-30255-E2 ..... N82-24042 #
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FR-15596 ..... N82-23246* #
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FRNC-TH-946 ..... N82-23503 #
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